The Impact of Welding Competencies of Senior High School and Differentiated Instruction on the Academic Performance of College Welding Students

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ABSTRACT

This study examined the relationship between Senior High School (SHS) welding competencies, differentiated instruction, and the academic performance of college welding students at Cebu Technological University–Main Campus enrolled in the Bachelor of Technical-Vocational Teacher Education (BTVTED) major in Welding and Fabrication Technology during the academic year 2025–2026. A descriptive-correlational research design was employed, and data were collected from 46 respondents using a structured questionnaire that assessed SHS welding competencies in terms of academic preparedness, practical skills, and technical knowledge, as well as students' perceptions of differentiated instruction in terms of content, process, and product. Academic performance was measured using self-reported grades. The findings revealed that respondents demonstrated a moderate level of SHS welding competencies, indicating the presence of foundational skills but insufficient preparation for college-level demands. In contrast, differentiated instruction practices were perceived to be highly evident, reflecting the use of varied teaching strategies to address diverse learner needs in technical-vocational education. Statistical analysis showed a significant moderate positive relationship between SHS welding competencies and differentiated instruction. However, no statistically significant relationship was found between SHS welding competencies and academic performance, nor between differentiated instruction and academic performance. These findings suggest that while prior competencies influence students' engagement with instructional strategies, academic performance may be affected by other factors beyond SHS preparation and teaching approaches. The study recommends strengthening bridging programs, enhancing hands-on training, improving assessment practices, and sustaining differentiated instruction to better support student learning outcomes.

Keywords: Technology and Vocational Education, SHS welding competencies, differentiated instruction, academic performance, descriptive-correlational design, Cebu City Philippines

INTRODUCTION

Technical-vocational education plays a crucial role in developing industry-relevant competencies, particularly in specialized fields such as welding and fabrication technology. In the Philippines, the implementation of the K to 12 Basic Education Program has positioned Senior High School (SHS) as a preparatory stage where learners acquire foundational knowledge and technical skills through the Technical-Vocational-Livelihood (TVL) track. This initiative aims to enhance students' readiness for higher education and employment by equipping them with competencies aligned with industry standards.

Despite this objective, students entering college welding programs exhibit varying levels of preparedness. While some learners possess prior exposure to welding through SHS training, a significant number come from non-technical strands and lack foundational knowledge and hands-on experience. This variation creates disparities in students' ability to understand theoretical concepts, perform practical tasks, and adapt to the demands of college-level welding courses.

To address these differences in learner readiness, differentiated instruction has been widely implemented in technical-vocational education. This approach emphasizes the adaptation of instructional content, learning processes, and assessment outputs based on students' varying abilities, interests, and learning profiles. Through differentiated instruction, educators aim to provide equitable learning opportunities and support students in achieving desired learning outcomes regardless of their prior preparation.

However, while previous studies have examined SHS preparation and differentiated instruction independently, limited empirical evidence exists on how these two factors jointly influence the academic performance of college welding students, particularly within the Philippine technical-vocational education context. Moreover, the extent to which prior welding competencies shape students' engagement with differentiated instruction and contribute to their academic success remains insufficiently explored.

Given these gaps, this study aims to examine the relationship between SHS welding competencies, differentiated instruction, and the academic performance of college welding students enrolled in the Bachelor of Technical-Vocational Teacher Education (BTVTED) program major in Welding and Fabrication Technology at Cebu Technological University–Main Campus. Specifically, it seeks to determine the level of SHS welding competencies, assess students' perceptions of differentiated instruction practices, and analyze the relationships among these variables in relation to academic performance.

By providing empirical evidence on the interplay between prior competencies and instructional strategies, this study contributes to the improvement of teaching practices and curriculum alignment in technical-vocational education. The findings may serve as a basis for designing targeted interventions, strengthening bridging programs, and enhancing instructional approaches to better support diverse learners in welding education.

Theoretical Background

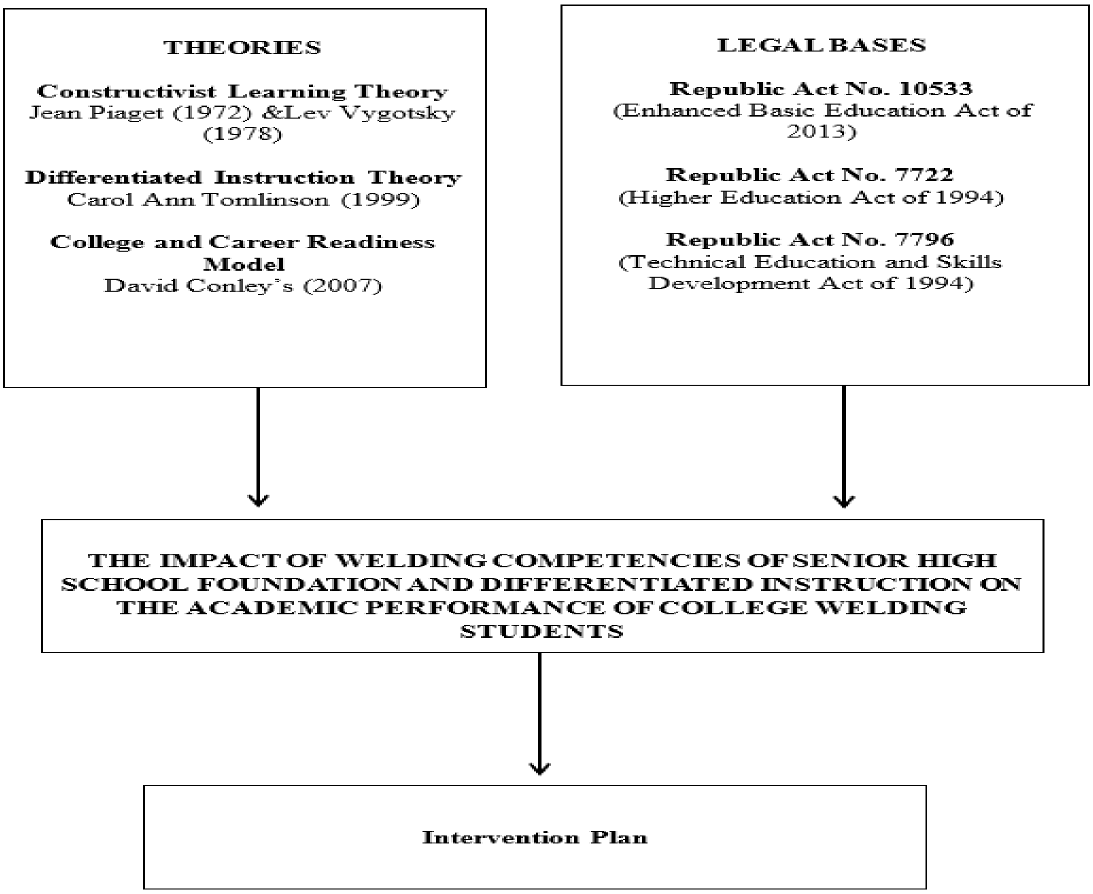
This study examines how SHS-acquired welding competencies and differentiated instruction contribute to the academic performance of college welding students. It is anchored on Constructivist Learning Theory, Differentiated Instruction Theory, and the College and Career Readiness Model, all of which emphasize the role of prior learning experiences and instructional strategies in shaping student outcomes. Furthermore, this study supports key Philippine education policies, including Republic Act No. 10533 (Enhanced Basic Education Act of 2013), Republic Act No. 7722 (Higher Education Act of 1994), and Republic Act No. 7796 (TESDA Act of 1994), which collectively promote quality, industry-relevant, and competency-based technical education. These frameworks underscore the importance of examining SHS welding competencies and instructional practices in relation to the academic performance of Bachelor of Technical-Vocational Teacher Education (BTVTED) students majoring in Welding and Fabrication Technology.

This study is grounded in Constructivist Learning Theory as proposed by Jean Piaget (1972) and Lev Vygotsky (1978), as interpreted by Kouicem (2020), which posits that learning is an active process wherein learners construct knowledge based on prior experiences. In this context, SHS TVL-Welding education serves as the foundational learning experience that influences students' readiness for advanced college-level welding instruction. Learners who have undergone SHS welding training are expected to demonstrate higher levels of academic and practical preparedness compared to those without such exposure. Vygotsky's concept of the Zone of Proximal Development further emphasizes the importance of scaffolding and instructional support in bridging learners' current abilities toward higher levels of competence. In addition, Differentiated Instruction Theory (Tomlinson, 2017) highlights the need for responsive teaching strategies that address learners' varying readiness levels, interests, and learning profiles through modifications in content, process, and product. Meanwhile, Conley's (2007) College and Career Readiness Model provides a framework for understanding preparedness through cognitive strategies, content knowledge, academic behaviors, and contextual skills. Together, these theories establish that both prior SHS welding experiences and adaptive instructional practices significantly influence students' academic performance and skill development in higher education.

The legal foundations of this study further reinforce its conceptual framework. Republic Act No. 10533, or the Enhanced Basic Education Act of 2013, institutionalizes the K to 12 curriculum, which includes the SHS TVL track designed to provide students with industry-relevant competencies in fields such as welding. This ensures that learners are introduced to foundational technical skills prior to entering college-level specialization. Republic Act No. 7722, or the Higher Education Act of 1994, mandates the Commission on Higher Education

(CHED) to ensure quality and relevant tertiary education, including technical-vocational programs such as BTVTED. Meanwhile, Republic Act No. 7796, or the TESDA Act of 1994, establishes competency-based technical and vocational training standards that emphasize the integration of theory and hands-on practice in skill acquisition. Collectively, these policies support the need to examine the alignment between SHS preparation, instructional strategies in college, and student performance outcomes in welding education.

Figure 1. Theoretical and Conceptual Framework of the Study



RESEARCH METHODOLOGY

Design

This study employed a descriptive-correlational research design to examine the relationship between Senior High School (SHS) welding competencies, differentiated instruction, and the academic performance of college welding students. This design was appropriate for the study as it enabled the researcher to describe the characteristics of the respondents and determine the relationships among variables without manipulating any conditions. According to Creswell (2017), correlational research is used to measure the strength and direction of relationships between variables, while Seeram (2019) emphasizes its usefulness in identifying factors that influence educational outcomes. The study focused on Bachelor of Technical-Vocational Teacher Education (BTVTED) students majoring in Welding and Fabrication Technology, analyzing how their SHS welding background and exposure to differentiated instruction relate to their academic performance in welding courses. Data were collected using research instruments and analyzed through statistical methods to determine the extent and significance of the relationships among the variables.

Environment

This study was conducted at Cebu Technological University – Main Campus (CTU–Main), located along M.J. Cuenco Avenue, Cebu City. As the flagship campus of the CTU system, it is recognized as one of the leading state universities in the Visayas, offering quality higher education and technical-vocational programs. Guided by its mission to promote innovation, research, and lifelong learning, CTU–Main accommodates a diverse student population from various regions of the Philippines, thereby fostering academic excellence and technical competence.

The university offers a wide range of programs in science, engineering, and technology, including Welding and Fabrication Technology under the College of Education. It is equipped with modern facilities such as laboratories, fabrication shops, and simulation rooms that support both theoretical and practical learning experiences. Qualified faculty members provide training in welding techniques, fabrication processes, and safety standards that are aligned with industry requirements, ensuring that students gain relevant and up-to-date competencies.

Located in the center of Cebu City, CTU–Main is strategically situated near industrial and commercial establishments that support students' exposure to on-the-job training and hands-on learning opportunities. These linkages enhance the employability of graduates by providing real-world experience prior to employment. As such, the campus serves as an appropriate setting for examining the influence of Senior High School preparation and differentiated instruction on the academic performance of college welding students.

Respondents

A total of forty-six (46) Bachelor of Technical-Vocational Teacher Education (BTVTED) students majoring in Welding and Fabrication Technology participated in the study. These respondents were distributed across year levels as follows: ten (10) first-year students (21.74%), twelve (12) second-year students (26.09%), thirteen (13) third-year students (28.26%), and eleven (11) fourth-year students (23.91%), as shown in Table 1. This distribution indicates that the respondents were fairly spread across all year levels, with a slightly higher concentration in the third-year level.

The initial pool of respondents consisted of seventy-two (72) students who were identified as potential participants in the study. However, only forty-six (46) students fully accomplished and returned the research questionnaire, resulting in a response rate of approximately 63.89%. The reduction in respondents was due to non-response factors such as unavailability during data collection, incomplete questionnaire submission, and refusal or failure to participate within the allotted data gathering period. No replacement sampling was conducted; thus, only the valid and complete responses were included in the final analysis.

To ensure the adequacy of the final sample, the researcher proceeded with 46 respondents, which is considered sufficient for descriptive-correlational analysis. In addition, efforts were made to minimize potential non-response bias by confirming that the available respondents still reflected the characteristics of the target population in terms of year level distribution and program enrollment. Accordingly, the analysis was conducted under the assumption that the collected responses adequately represent the accessible population. Nevertheless, the findings were interpreted with caution, acknowledging that the perceptions and competencies of non-respondents may differ from those included in the study.

Table 1. Distribution of Respondents

Category	Year Level	Sample (n)	Percentage (%)
BTVTED – Welding and Fabrication Technology	1st Year	10	21.74
	2nd Year	12	26.09
	3rd Year	13	28.26
	4th year	11	23.91
Total		**46**	**100**

Instrument

The survey questionnaire used in this study was adapted from Alinea et al. (2024) and Perez (2024), with necessary modifications to align with the objectives of the research. These modifications were made to examine the influence of Senior High School (SHS) welding competencies and differentiated instruction on the academic performance of college welding students, as well as to gather information on students' perceived skills prior to college enrollment, their academic preparedness upon entry to college, and their perceptions of differentiated instruction. It also assessed students' self-perceived competencies after completing SHS, particularly since objective expert ratings were not separately available. The respondents were part of the first batch of the K–12 program, where basic education was extended from 10 to 13 years.

The research instrument consists of three main parts. Part I, the Profile of the Respondents, collects demographic information such as gender, age, year level, SHS strand completed, and prior exposure to welding during SHS. Part II, Senior High School Welding Competencies, assesses respondents' academic preparedness, practical skills, and technical knowledge in welding through 31 items. Part III, Differentiated Instruction Practices, evaluates students' perceptions of content, process, and product differentiation implemented in their college welding classes through 15 items. Collectively, these sections provide a comprehensive assessment of the influence of SHS preparation and instructional practices on students' learning experiences in college welding education. A 5-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5) was used to measure respondents' perceptions quantitatively.

The study ensures strict confidentiality of all respondents' responses in accordance with the Data Privacy Act of 2012 (Republic Act No. 10173). All data collected were used solely for research purposes and were reported in a manner that guarantees anonymity and protects the identity of the participants.

Data Sources and Measurement of Variables

The SHS welding competencies and differentiated instruction were measured using a structured questionnaire aligned with the study objectives and adapted from Alinea et al. (2024) and Perez (2024). SHS competencies were assessed in terms of academic preparedness, practical skills, and technical knowledge, while differentiated instruction was evaluated based on students' perceptions of content, process, and product differentiation in college welding classes. Data were analyzed using weighted mean and standard deviation, with verbal interpretations used to describe the level of perception.

Academic performance was measured using self-reported general weighted averages categorized according to institutional grading standards. The responses were categorized according to the following Academic Performance (Grade Range): Excellent (1.00–1.75), Very Good (1.76–2.00), Good (2.01–2.50), and Fair (2.51–3.00). Due to limitations in accessing official academic records and in compliance with the Data Privacy Act of 2012 (Republic Act No. 10173), self-reported grades were used as proxy data. These responses were then classified into categorical performance levels for purposes of statistical analysis.

Data Gathering Procedure

Preliminary stage. During this stage, formal letters requesting permission to conduct the study were prepared and submitted to the appropriate authorities through the Department Head of the program. Upon approval, informed consent forms were developed and distributed to the respondents for their review and voluntary confirmation. After securing all necessary permissions and consent, the researcher proceeded to the data collection phase.

Data gathering stage. The research instrument was administered to the respondents following a brief orientation. During this session, participants were guided on how to properly accomplish the questionnaire, including an explanation of the response format and allotted time. Emphasis was also placed on the confidentiality of the respondents' information in accordance with the Data Privacy Act.

Post Data Gathering stage. Upon completion of data collection, the responses were organized, encoded, and subjected to appropriate statistical analysis. The processed data were then prepared for systematic presentation, thorough analysis, and interpretation in alignment with the objectives of the study.

RESULTS AND DISCUSSIONS

This section present the study's findings based on the data collected from the respondents. It explains how the data was analyzed and describes the respondents' profile to give a clear view of who participated in the study. The results are presented in an organized way to show key patterns and relationships.

Profile Of The Respondents

The following section presents and discusses the findings individually regarding the respondents' profile, specifically in terms of age, gender (male or female), year level, and completed Senior High School strand.

Age

The distribution of respondents according to their age in years is presented, showing the frequency and percentage of participants within each category, specifically those aged 16–20, 21–25, and 26 years and above.

Table 2. Age of the Respondents

Age (in years)	**f**	**%**
26 and above	1	2.17
21-25	21	45.65
16-20	24	52.17
Total	**46**	**100.00**

The data in Table 2 indicate that the majority of the respondents were aged 16–20 years, comprising 52.17% of the total sample, followed by those aged 21–25 years at 45.65%. Only a small proportion, 2.17%, belonged to the 26 years and above category. This distribution suggests that the respondents were predominantly within the younger age bracket, which is typical of students enrolled in undergraduate programs. The concentration of participants in the 16–25 age range implies that most are in the early stages of their higher education, where foundational knowledge and skills are still being developed.

Overall, the findings reflect a relatively homogeneous age distribution dominated by younger learners, which provides a focused context for interpreting the study's results. This suggests that the conclusions drawn are most applicable to college welding students within this common age range, particularly those transitioning directly from Senior High School to higher education.

Gender

The frequency and percentage distribution of respondents according to gender are presented, showing the proportion of male and female participants in the study. This provides an overview of the gender composition of the sample, which is essential in understanding the demographic profile of the respondents involved in the study, as shown in Table 3.

Table 3. Gender of the Respondents

Gender	**f**	**%**
Female	28	60.87

Male	18	39.13
Total	**46**	**100.00**

The data presented in Table 3 show that the majority of the respondents were female, comprising 60.87% (f = 28) of the total sample, while male respondents accounted for 39.13% (f = 18). This indicates that female participants outnumbered their male counterparts in the study population. The distribution suggests a relatively uneven representation in terms of gender, with a higher participation rate among female students.

Overall, the findings indicate that the study is primarily represented by female respondents, which may influence the interpretation of results in relation to gender-related differences in learning experiences, competencies, and perceptions of differentiated instruction.

Year Level

Table 4 presents the distribution of respondents according to their respective year levels, along with the corresponding percentages for each category. It illustrates the number of participants coming from first-year, second-year, third-year, and fourth-year levels, thereby showing how the sample is spread across different stages of academic progression. This information provides a clearer understanding of how respondents from various year levels are represented in the study. Moreover, it indicates that the data were gathered from students who have already been exposed to welding and fabrication-related subjects, ensuring relevance to the research focus.

Table 4. Year Level of the Respondents

Year Level	**f**	**%**
4th Year	11	23.91
3rd Year	13	28.26
2nd Year	12	26.09
1st Year	10	21.74
Total	**46**	**100.00**

The data presented in Table 4 show that respondents were fairly distributed across different year levels, with third-year students having the highest representation (28.26%), followed closely by second-year students (26.09%). Fourth-year students accounted for 23.91%, while first-year students had the lowest participation at 21.74%. This relatively even distribution suggests that the study captured perspectives from various stages of the academic journey, although there is a slight concentration in the middle years. Such a spread allows for a more comprehensive understanding of students' experiences and skill development in welding programs.

In summary, the inclusion of respondents from all year levels, with a slight emphasis on the middle years, contributed to a balanced and diverse dataset. This distribution strengthens the study by providing a broader perspective on student experiences, thereby supporting more accurate and meaningful interpretations of the findings.

Senior High School Strand Completed

The distribution of respondents according to the Senior High School (SHS) strand they completed is presented to examine how their respective academic tracks may have contributed to their preparation in relation to their chosen field and skill set. This classification provides a clearer understanding of the respondents' academic background and prior specialization, as summarized in Table 5.

Table 5. Senior High School Strand Completed by the Respondents

SHS Strand	**f**	**%**
Accountancy, Business, and Management (ABM)	3	6.52
General Academic Strand (GAS)	10	21.74
Humanities and Social Sciences (HUMSS)	16	34.78
Information Communication and Technology (ICT)	1	2.17
Science, Technology, Engineering, and Mathematics (STEM)	1	2.17
Technical-Vocational-Livelihood (TVL)	15	32.61
Total	**46**	**100.00**

The data in Table 5 show that most respondents came from the HUMSS strand (34.78%) and TVL (32.61%), followed by GAS (21.74%), while ABM (6.52%), ICT, and STEM (2.17% each) had minimal representation. This indicates that a large portion of the respondents did not primarily come from highly technical strands, with only a small percentage having strong technical or science-based backgrounds. Such variation suggests that students entering welding programs possess differing levels of prior knowledge and skills, which may influence their adaptability and performance in technical coursework.

In summary, the varied SHS strand backgrounds of the respondents reflect differences in technical preparedness, which may affect their welding competencies and academic performance. This diversity underscores the need for adaptive and differentiated teaching strategies to support students with both technical and non-technical backgrounds, ensuring more inclusive and effective learning outcomes in welding education.

Enrollment in Welding under the TVL Track in Senior High School

The enrollment profile of the respondents who took welding subjects under the Technical-Vocational-Livelihood (TVL) track in Senior High School is examined, with particular emphasis on those who have completed formal training in welding. This information serves as a basis for understanding their foundational knowledge and exposure to welding competencies, which may influence their preparedness for more advanced welding instruction at the tertiary level. The summarized distribution of these respondents is presented in Table 6.

Table 6. Senior High School Welding Experience of the Respondents

Enrolled in TVL Welding	**f**	**%**
No	38	82.61
Yes	8	17.39
Total	**46**	**100.00**

The data in Table 6 reveal that a significant majority of respondents (82.61% or 38 students) had no prior exposure to welding courses during their Senior High School education, while only 17.39% (8 students) had taken welding under the TVL track. This indicates that most students entered college welding programs without foundational knowledge or hands-on experience, which may affect their initial performance, confidence, and ability to grasp practical skills. The findings highlight a gap in prior technical preparation among the respondents.

In summary, the findings show that only a small portion of students had formal welding training before college, while the majority relied solely on their college education to develop their skills. This situation underscores the importance of implementing differentiated instruction to accommodate varying levels of experience, helping students build confidence, improve competence, and successfully adapt to the demands of welding education.

Respondent's Perceived Level Of Shs Welding Competencies

The following section presents the respondents' perceptions of their Senior High School (SHS) welding competency levels, focusing on three key components: academic readiness, practical experience in performing welding tasks, and technical expertise in welding. This information is essential in understanding how respondents evaluate their own preparedness in relation to learning readiness, hands-on welding experience, and overall competency in the field. These perceived competencies may have significant implications for their academic performance in college-level welding courses. Furthermore, examining these perceptions provides valuable insights that may guide the development of appropriate instructional strategies aimed at enhancing both academic and technical performance in welding education.

Academic Preparedness

The respondents' Senior High School (SHS) welding competence was examined to determine their level of preparedness for college-level instruction, with particular attention to their study skills, understanding of welding theory, problem-solving abilities, and overall readiness for advanced technical training. This assessment provides an indication of the extent to which their prior learning experiences have equipped them with the foundational competencies required in higher education welding courses. The summarized results of this evaluation are presented in Table 7.

Table 7. Respondent's Perceived Level of SHS Welding Competencies in Terms of Academic Preparedness

S/N	Indicators	WM	SD	Verbal Description
1	My SHS education helped me develop study habits useful for college welding courses.	2.72	1.46	Moderate
2	I was academically prepared for theoretical concepts in college welding subjects.	2.76	1.23	Moderate
3	I had sufficient mathematics knowledge before entering college.	3.15	1.03	Moderate
4	I had sufficient science knowledge before entering college.	3.30	0.96	Moderate
5	I developed problem-solving skills applicable to welding tasks.	3.04	1.01	Moderate
6	I could understand welding theories taught in college without difficulty.	2.89	0.97	Moderate
7	My SHS background helped me perform better in college welding subjects.	2.70	1.24	Moderate
8	I could relate theoretical knowledge from SHS to welding applications in college.	2.67	1.19	Moderate
9	I needed minimal additional guidance from college instructors.	3.76	1.08	High
10	My SHS foundation positively influenced my academic performance in welding.	2.85	1.15	Moderate

	Aggregate Weighted Mean	**2.98**		**Moderate**
	Aggregate Standard Deviation		**1.13**	

Legend: 4.21-5.00 – Very High; 3.41-4.20 – High; 2.61-3.40 – Moderate; 1.81-2.60 – Low; 1.00-1.80 – Very Low

An examination of Table 7 presents the respondents perceived competence in Senior High School (SHS) welding and how it relates to their preparedness for college welding classes. The overall weighted mean falls under the Moderate category, indicating that while students consider their SHS preparation to be adequate, it is not strong enough to fully meet the academic and technical demands of college-level welding. This suggests that students possess foundational knowledge but may struggle with more complex concepts such as measurements, calculations, and advanced applications required in higher education.

In summary, the weighted mean of 2.98 indicates that respondents have a moderately good level of academic readiness, but notable gaps remain in their preparation for college welding. Although SHS provides a basic foundation, it is not sufficient to fully support the demands of advanced learning. This highlights the need for differentiated instruction in college, allowing educators to tailor teaching strategies and assessments to students' varying competencies, ultimately enhancing their skills, confidence, and overall performance in welding education.

Practical Skills

The respondents' self-assessed practical welding skills were evaluated to determine their proficiency, safety compliance, and readiness for college-level welding activities. The assessment covered equipment use, welding procedures, safety practices, and understanding of technical instructions, providing insight into how their SHS exposure has developed their hands-on competencies. It also identified their strengths and areas needing improvement to meet required proficiency standards. The summarized results are presented in Table 8.

Table 8. Respondent's Perceived Level of SHS Welding Competencies in Terms of Practical Skills

S/N	**Indicators**	**WM**	**SD**	**Verbal Description**
1	I had opportunities to prepare materials, tools, and equipment for welding before college.	2.67	1.14	Moderate
2	I was familiar with performing welding operations.	2.87	1.22	Moderate
3	I could follow welding procedures accurately.	3.07	1.18	Moderate
4	I applied proper safety procedures and consistently used PPE.	3.67	1.21	High
5	I could produce welding outputs according to specifications and quality standards.	3.07	1.14	Moderate
6	I could check and inspect welds for quality and accuracy.	3.04	1.23	Moderate
7	I developed good hand-eye coordination and technical craftsmanship.	3.04	1.07	Moderate
8	I was confident performing welding tasks before entering college.	2.65	1.30	Moderate
9	SHS practical training helped me adapt quickly to college-level welding tasks.	2.70	1.21	Moderate

10	I needed minimal supervision during hands-on activities.	3.20	1.19	Moderate
	Aggregate Weighted Mean	**3.00**		**Moderate**
	Aggregate Standard Deviation		**1.19**	

Legend: 4.21-5.00 – Very High; 3.41-4.20 – High; 2.61-3.40 – Moderate; 1.81-2.60 – Low; 1.00-1.80 – Very Low

The respondents' perceived level of practical competence in SHS welding is illustrated in Table 8, based on their self-assessment of skills. The overall weighted mean of 3.00 indicates a moderate level of proficiency, suggesting that students have developed basic practical abilities but have not yet attained advanced skill mastery. Most indicators, including adherence to welding procedures, quality of output, and hand-eye coordination, were rated as "Moderate," while safety practices and proper use of personal protective equipment (PPE) obtained a "High" rating (WM = 3.67). This implies that although students demonstrate strong awareness of safety protocols, their technical execution and refinement of welding skills still require further development.

In summary, the results indicate that respondents possess an average level of practical welding skills acquired during SHS, with strong awareness of safety but moderate technical proficiency. This underscores the need for more advanced, hands-on, and differentiated instructional strategies in college to further develop students' skills, enhance their confidence, and ensure their readiness for higher-level welding tasks.

Technical Knowledge Related to Welding

The respondents' perceived welding competency in terms of technical know-how was assessed based on their mastery of materials, equipment, methods, and standards, as these are essential factors affecting their academic performance in college welding courses. The evaluation reflects how their foundational technical knowledge supports their progression in advanced training. The results are presented in Table 9.

Table 9. Respondent's Perceived Level of SHS Welding Competencies in Terms of Technical Knowledge Related to Welding

S/N	Indicators	WM	SD	Verbal Description
1	I had knowledge of different metals and materials before college.	2.70	1.17	Moderate
2	I understood the properties of metals used in welding.	2.89	1.20	Moderate
3	I was familiar with workshop tools and equipment.	3.35	1.18	Moderate
4	I understood basic fabrication procedures.	2.85	1.28	Moderate
5	I had exposure to basic welding or industrial tasks before college.	2.48	1.30	Low
6	I understood the importance of worksite safety and health standards.	3.59	1.42	High
7	I could read and interpret welding drawings or diagrams.	2.80	1.20	Moderate
8	I could apply theoretical knowledge in practical tasks.	2.87	1.17	Moderate
9	Support from instructors helped me improved my technical	3.74	1.10	High

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	knowledge.			
10	My technical knowledge from SHS contributed to better performance in college welding courses.	2.52	1.26	Low
	Aggregate Weighted Mean	**2.98**		**Moderate**
	Aggregate Standard Deviation		**1.23**	

Legend: 4.21-5.00 – Very High; 3.41-4.20 – High; 2.61-3.40 – Moderate; 1.81-2.60 – Low; 1.00-1.80 – Very Low

The respondents' perceived level of SHS welding competencies in terms of technical knowledge, as shown in Table 9, indicates an overall weighted mean of 2.98, interpreted as a moderate level of technical understanding among the respondents. This suggests that the students have acquired basic theoretical knowledge in areas such as metals, fabrication processes, weld drawings, and application of concepts; however, their mastery of these competencies remains limited. Notably, worksite safety and instructor support obtained high ratings, with weighted means of 3.59 and 3.74, respectively, reflecting strong awareness of safety protocols and the significant role of instructors in the development of technical skills. In contrast, basic welding processes and the perceived contribution of SHS technical knowledge were rated lower, with weighted means of 2.48 and 2.52, indicating gaps in foundational technical competencies.

In summary, the respondents demonstrated a moderate level of technical knowledge in SHS welding, with strong awareness of safety and reliance on instructor support but weaker mastery of core welding processes. This indicates that while SHS provides an essential foundation, it is not enough to ensure full technical competence. Therefore, targeted and differentiated instructional strategies in college are necessary to bridge these gaps, strengthen technical skills, and improve overall performance in welding education.

Summary on the Respondents' Perceived Level of SHS Welding Competencies

The analysis of the respondents' self-perception regarding their proficiency in welding skills at the Senior High School (SHS) level in terms of academic preparation, skill development, and knowledge regarding welding was given. The statistical measures used include the computation of weighted means, standard deviation, and description in words. This will help in understanding the self-perception of the respondents on their SHS welding competencies, as shown in Table 10.

Table 10. Summary on the Respondents' Perceived Level of SHS Welding Competencies

Components	**WM**	**SD**	**Verbal Description**
Academic Preparedness	2.98	1.13	Moderate
Practical Skills	3.00	1.19	Moderate
Technical Knowledge Related to Welding	2.98	1.23	Moderate
Grand Mean	**2.99**		**Moderate**
Grand Standard Deviation		**1.18**	

Legend: 4.21-5.00 – Very High; 3.41-4.20 – High; 2.61-3.40 – Moderate; 1.81-2.60 – Low; 1.00-1.80 – Very Low

Table 10 presents a comprehensive view of the respondents' perceived SHS competencies in welding in terms of academic preparedness, practical skills, and technical knowledge. The overall mean score of 2.99 falls under the Moderate category, indicating that respondents felt they were only sufficiently prepared for welding in Senior High School but not fully equipped for advanced demands. Specifically, academic preparedness (WM = 2.98) suggests that students had a fair understanding of theoretical concepts, while practical skills (WM = 3.00) reflect a moderate level of hands-on experience in welding activities. Likewise, technical knowledge (WM = 2.98) shows that respondents had basic awareness of materials, equipment, and welding techniques, but not at an advanced or highly competent level.

In summary, the findings indicate that respondents possess an average level of SHS welding competency across academic, practical, and technical dimensions. While SHS provides essential foundational learning, it is not sufficient to fully prepare students for the complexities of college-level welding. This reinforces the need for differentiated instruction and more advanced training strategies in college to address varying student competencies and ensure improved performance in welding education.

Respondents' Level Of Perception On Differentiated Instruction Practices Experienced In Their College Welding Classes

This section presents the respondents’ level of perception on the differentiated instruction practices experienced in their college welding classes. It examines how instructional strategies are adapted to address learners’ varying abilities, needs, and learning preferences. Specifically, the analysis focuses on three key dimensions of differentiated instruction: content differentiation, process differentiation, and product differentiation. These components provide a comprehensive understanding of how instructors modify learning materials, teaching methods, and assessment outputs to support diverse learners in welding education.

Content Differentiation

The degree of respondents’ perception of differentiated instruction strategies experienced in their college welding courses, particularly in terms of content differentiation, was assessed. This aspect focuses on how instructional materials, teaching approaches, and learning resources are adapted to accommodate students’ varying levels of ability and learning needs. As presented in Table 11, the analysis includes the computed weighted mean scores, standard deviations, and corresponding interpretations for each indicator. These statistical measures provide a clear representation of how students perceive the extent to which instructors modify lesson content, utilize diverse teaching methods, incorporate practical and real-world examples, and adjust instructional delivery to address differences in learners’ competencies. Through this assessment, the study highlights the role of content differentiation in promoting inclusive and responsive teaching practices in college welding education.

Table 11. Respondents' Level of Perception on Differentiated Instruction Practices Experienced in their College Welding Classes in Terms of Content Differentiation

S/N	INDICATORS	WM	SD	Verbal Description
1	My instructor provides different learning materials suited to our skill levels.	3.80	1.13	High
2	Lessons are presented using varied teaching methods.	3.78	1.03	High
3	My instructor explains topics using examples related to real welding situations.	3.93	1.18	High
4	I receive additional materials when I find a topic difficult.	3.52	1.17	High
5	My instructor adjusts lessons to help both advance and struggling students.	3.87	1.22	High
	Aggregate Weighted Mean	**3.78**		**High**

	Aggregate Standard Deviation		**1.15**	

Legend: 4.21-5.00 – Very High; 3.41-4.20 – High; 2.61-3.40 – Moderate; 1.81-2.60 – Low; 1.00-1.80 – Very Low

Table 11 presents the respondents' perception of differentiated instruction practices in college welding courses specifically in terms of content differentiation. The results show a computed weighted mean of 3.78, which falls under the High category. This indicates that respondents strongly perceive that instructional content is appropriately adjusted according to learners' varying abilities. It further suggests that instructors in college welding classes actively provide differentiated learning materials, ensuring that both advanced and struggling learners are given appropriate academic support. As a result, students experience lessons that are better aligned with their individual learning needs and skill levels.

In summary, the high level of content differentiation reflects the effectiveness of instructors in adapting learning materials to meet diverse student needs. This practice helps bridge competency gaps, supports both weak and advanced learners, and promotes better understanding of welding concepts. Overall, differentiated content contributes to a more inclusive and responsive learning environment where students are better able to participate, comprehend lessons, and succeed in their welding coursework.

Process Differentiation

This study examined respondents' perception of differentiated instruction in college welding classes, particularly in terms of process differentiation, as shown in Table 12. These strategies reflect how instruction is adapted through pacing, grouping, practice, feedback, and demonstration to address varying skill levels and learning styles in welding education.

Table 12. Respondents' Level of Perception on Differentiated Instruction Practices Experienced in their College Welding Classes in Terms of Process Differentiation

S/N	INDICATORS	WM	SD	Verbal Description
1	My instructor provides step-by-step guidance during hands-on activities.	4.00	1.03	High
2	I am given opportunities to learn at my own pace.	3.78	1.03	High
3	The instructor groups us based on our abilities or learning needs.	3.54	1.19	High
4	I receive feedback that helps me improve my practical performance.	3.93	1.10	High
5	My instructor uses demonstrations suited to our learning styles.	3.83	1.12	High
	Aggregate Weighted Mean	**3.82**		**High**
	Aggregate Standard Deviation		**1.10**	

Legend: 4.21-5.00 – Very High; 3.41-4.20 – High; 2.61-3.40 – Moderate; 1.81-2.60 – Low; 1.00-1.80 – Very Low

Table 12 presents the respondents' perception of process differentiation in college welding lessons. The results reveal a high level of perception, with a weighted mean of 3.82, indicating that instructors frequently employ varied teaching strategies to accommodate diverse learners. The highest-rated indicators include the use of detailed instructions during hands-on activities (WM = 4.00) and the provision of constructive feedback to improve student performance (WM = 3.93). This suggests that the teaching process in welding classes is actively adjusted to support students with different learning needs and skill levels.

In summary, the high level of process differentiation demonstrates that instructors effectively adjust teaching methods to support varying learner needs in welding education. This approach enhances student engagement, improves skill development, and strengthens understanding of both theoretical and practical components. Overall, process differentiation plays a crucial role in improving learning outcomes and supporting the success of college welding students.

Product Differentiation

The degree of respondents' perception of differentiated instructional strategies experienced during their college welding training in terms of product differentiation was determined, with results presented in Table 13 reflecting weighted mean values, standard deviations, and verbal descriptions related to flexibility in demonstrating outputs, choice, feedback, creativity, and equitable assessment.

Table 13. Respondents' Level of Perception on Differentiated Instruction Practices Experienced in their College Welding Classes in Terms of Product Differentiation

S/N	INDICATORS	WM	SD	Verbal Description
1	We are allowed to show learning outcomes in different formats (project, report, or performance).	3.98	1.00	High
2	I am given options to choose project topics or designs.	3.61	1.06	High
3	I receive individual feedback for my completed works.	3.83	1.04	High
4	The instructor recognizes our creativity and initiative in welding projects.	3.78	1.03	High
5	My grades reflect both effort and performance in practical work.	3.85	1.13	High
	Aggregate Weighted Mean	**3.81**		**High**
	Aggregate Standard Deviation		**1.05**	

Legend: 4.21-5.00 – Very High; 3.41-4.20 – High; 2.61-3.40 – Moderate; 1.81-2.60 – Low; 1.00-1.80 – Very Low

Table 13 presents the respondents' perception of differentiated instruction practices in terms of product differentiation. The results show an overall weighted mean of 3.81, interpreted as a High level of perception. This indicates that students strongly recognize and appreciate the flexibility provided by instructors in allowing them to demonstrate learning outcomes through various outputs such as projects, reports, and hands-on demonstrations. It suggests that assessment practices in college welding courses are designed to accommodate different strengths and learning preferences among students.

In summary, the high level of perceived product differentiation reflects the effectiveness of allowing students to express their competencies through varied assessment methods. This approach enables learners to demonstrate skills according to their strengths and capabilities, resulting in a more inclusive and flexible evaluation process. Overall, product differentiation enhances confidence, encourages active participation, and supports both technical and academic development among college welding students.

Summary on the Respondents' Level of Perception on Differentiated Instruction Practices Experienced in Their College Welding Classes

A summary of the perceptions level of the respondents concerning the differentiated instruction practices which they have encountered in their college welding subjects was provided shown in table 14, pointing out the three main factors involved in differentiated instruction: content, process, and product differentiation. These factors were shown through the analysis of mean scores, standard deviations, and description of each category. The results showed a general picture of how students viewed differentiated instruction practices tailored to various learning styles and skills in terms of content, process, and product.

Table 14. Summary on the Respondents' Level of Perception on Differentiated Instruction Practices Experienced in Their College Welding Classes

Components	**WM**	**SD**	**Verbal Description**
Content Differentiation	3.78	1.15	High
Process Differentiation	3.82	1.10	High
Product Differentiation	3.81	1.05	High
Grand Mean	**3.80**		**High**
Grand Standard Deviation		**1.10**	

Table 14 presents the overall level of respondents' perception of differentiated instruction strategies in college welding classes, focusing on content, process, and product differentiation. The results show consistently high weighted mean scores for all three areas: content (3.78), process (3.82), and product (3.81), all of which fall under the High category. This indicates that students generally perceive differentiated instruction practices as effectively implemented in their welding classes. It further suggests that learning experiences are appropriately adjusted in terms of instructional materials, teaching strategies, and assessment outputs to meet the varying needs of learners.

In summary, the consistently high perception across content, process, and product differentiation indicates that differentiated instruction is effectively practiced in college welding classes. These strategies not only enhance student engagement and skill development but also strengthen the connection between Senior High School preparation and college-level learning demands. Overall, differentiated instruction plays a vital role in improving academic performance, technical competence, and readiness in welding education.

Academic Performance

The academic performance of the respondents in their college welding courses was assessed to determine their overall level of achievement based on their self-reported grades. This provides an indication of how well the students are performing in relation to the demands of their program. It also offers insight into their ability to meet both the theoretical and practical requirements of welding education. Furthermore, this assessment serves as a basis for examining the relationship between students' competencies and instructional practices. The results are presented in Table 15.

Table 15. Distribution of Respondents' Academic Performance

Academic Performance (Grade Range)	**f**	**%**
Excellent (1.00–1.75)	37	80.43
Very Good (1.76–2.00)	7	15.22
Good (2.01–2.50)	2	4.35
Fair (2.51–3.00)	0	0.00

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Total	**46**	**100.00**

Table 15 presents the distribution of respondents' academic performance based on self-reported grades. The majority of respondents (80.43%) fall under the Excellent category, followed by 15.22% classified as Very Good and 4.35% as Good, with no respondents under the Fair category.

These results indicate a consistently high level of academic performance among the respondents. However, the concentration of scores in the Excellent category suggests limited variability, which may influence the detection of significant relationships with other variables. Overall, the findings reflect strong academic achievement among college welding students.

Test Of Significance Of Relationships Among Shs Welding Competencies, Differentiated Instruction, And Academic Performance

Test for the correlation between students' perception of SHS welding skills and perception of differentiated instruction was conducted. The test entails the r-value, strength of correlation, p-value, and the null hypothesis decision. It proved if there was a significant correlation between students' welding skills acquired in high school and the use of differentiated instruction in college welding courses. This enabled one to find out if the skills acquired in high schools influenced the students' perception of differentiated instruction in college, as presented in Table 16 below.

Table 16. Test of Significance of Relationship Between Respondents' Perception on SHS Welding Competencies and Differentiated Instruction Practices Experienced

Variables	**r-value**	**Strength of Correlation**	**p-value**	**Decision**	**Result**
Academic Preparedness vs Academic Performance	-0.073	Negligible	0.623	Fail to Reject Ho	Not Significant
Practical Skills vs Academic Performance	-0.081	Negligible	0.585	Fail to Reject Ho	Not Significant
Technical Knowledge vs Academic Performance	0.024	Negligible	0.870	Fail to Reject Ho	Not Significant
Differentiated Instruction vs Academic Performance	-0.142	Weak Negative	0.336	Fail to Reject Ho	Not Significant
SHS Welding Competencies vs Differentiated Instruction	0.418	Moderate Positive	0.003	Reject Ho	Significant
*significant at p<0.05 (two-tailed)					

Table 16 presents the test of significance of the relationships among SHS welding competencies, differentiated instruction, and academic performance. The results show no statistically significant relationship between SHS welding competencies and academic performance, as indicated by p-values greater than 0.05 for academic preparedness (p = 0.623), practical skills (p = 0.585), and technical knowledge (p = 0.870). Similarly, differentiated instruction is not significantly related to academic performance (r = -0.142, p = 0.336).

These findings indicate that neither SHS competencies nor differentiated instruction significantly predict academic performance. This may be partly due to limited variability in grades, as most respondents fall within the Excellent category.

In contrast, a statistically significant moderate positive relationship was found between SHS welding competencies and differentiated instruction ($r = 0.418$, $p = 0.003$), suggesting that students with stronger prior competencies tend to respond more positively to instructional strategies.

Overall, the results imply that academic performance may be influenced by factors beyond SHS preparation and instructional practices.

FINDINGS

The findings show that the respondents were predominantly young college students, with a higher proportion of female participants and representation across all year levels. Most respondents came from the Humanities and Social Sciences (HUMSS) and Technical-Vocational-Livelihood (TVL) strands, and the majority had no formal welding training during Senior High School (SHS). In terms of SHS welding competencies, respondents demonstrated a moderate level of academic preparedness, practical skills, and technical knowledge, suggesting that they possessed basic foundational competencies but were not fully equipped for the demands of college-level welding education. On the other hand, differentiated instruction practices in college welding classes were perceived to be highly evident across content, process, and product differentiation, indicating that instructors actively implement adaptive teaching strategies to address diverse learner needs. Statistical analysis further revealed a significant moderate positive relationship between SHS welding competencies and differentiated instruction. However, no statistically significant relationship was found between SHS welding competencies and academic performance, nor between differentiated instruction and academic performance, indicating that academic outcomes may be influenced by other factors beyond SHS preparation and instructional strategies.

CONCLUSION

The study concludes that college welding students generally enter higher education with moderate SHS welding competencies regardless of their SHS strand, suggesting that while SHS provides foundational knowledge and skills, it is insufficient to fully prepare students for the advanced technical and academic demands of college-level welding education. The study also reveals that differentiated instruction is highly implemented in college welding classes, reflecting instructors' efforts to accommodate diverse learner needs through varied teaching strategies in content, process, and product. Furthermore, a significant moderate positive relationship was found between SHS welding competencies and differentiated instruction, indicating that students with stronger prior competencies tend to respond more positively to adaptive instructional practices. However, the study found that neither SHS welding competencies nor differentiated instruction have a statistically significant relationship with academic performance, implying that academic outcomes in welding education may be influenced by other factors such as grading practices, student motivation, or limited variability in performance. Overall, the findings highlight the importance of strengthening foundational competencies and instructional practices while also considering other determinants of academic success in technical-vocational education.

RECOMMENDATIONS

Based on the findings and conclusions of the study, it is recommended that colleges implement structured bridging programs to address gaps in students' prior welding competencies, particularly for those with limited SHS exposure, and strengthen hands-on and industry-based training to enhance practical skills and technical competence. Institutions are also encouraged to sustain and further improve differentiated instruction practices to better accommodate diverse learner needs and skill levels. Additionally, academic institutions should review and refine their assessment and grading systems to ensure that academic performance accurately reflects students' competencies and skill development. Finally, future researchers are encouraged to explore other factors that may influence academic performance, such as student motivation, learning environment, instructional quality, and assessment methods, to provide a more comprehensive understanding of student outcomes in welding education.

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