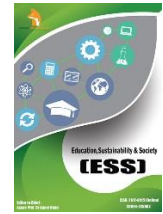




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## RESEARCH ARTICLE

# COLLEGE OF ARTS AND SCIENCES STUDENTS' LEVELS OF PROBLEM SOLVING, COLLABORATION AND ADAPTABILITY SKILLS: BASIS FOR CURRICULUM ENHANCEMENT

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## ABSTRACT

Problem-solving, collaboration and adaptability are the three critical skills that Education 4.0 must impart to learners. This study investigated the levels of these skills among 114 college students from the College of Arts and Sciences of San Pablo Colleges and used the findings as a basis for curriculum enhancement. The study used a quantitative research design through a survey. The data collected from the survey were analyzed using descriptive statistics, such as means and standard deviations and inferential statistics, such as correlation to identify relationships between the variables. Overall, findings suggest that college students have high levels of proficiency in problem-solving, collaboration, and adaptability skills. However, some areas need attention in developing problem-solving abilities. When grouped according to profiles, collaboration skills among lower year levels were significantly lower among the four levels while adaptability skills according to courses were revealed to be a factor to implement cross-disciplinary activities exposing them to diverse scenarios. Recommendations were made to college administrators to incorporate more opportunities for learners to develop these skills through courses, programs, and extracurricular activities.

## KEYWORDS

Education 4.0, Curriculum Enhancement, Problem-Solving, Collaboration, Adaptability

## 1. INTRODUCTION

As Education 4.0 takes shape, it is becoming more and more apparent that learners need to be given the fundamental skills necessary to succeed in a challenging environment. Likewise, the necessity to concentrate on assisting students in developing a wide range of abilities has also been accepted on a worldwide scale. It exposed us to the information, abilities, attitudes, and values that are essential to living in the 21<sup>st</sup> century (Care & Luo, 2016). Since then, the emphasis to "holistically developed Filipino learner" that embraces these abilities has been accentuated in our nation's educational system. Specifically, problem-solving, teamwork, and flexibility stand out among these abilities as being crucial for learners to excel in both their personal and professional life allowing them to thrive with the demands of the modern industries (Androniceanu, 2017).

Objectively, this paper will assess the levels of problem-solving, collaboration, and adaptability skills among the 114 college students from College of Arts and Sciences while comparing the demographic profiles. It will reveal any major connections or correlations between the college students' problem-solving, collaboration, and adaptability abilities while pointing out particular areas where college students' problem-solving, cooperation, and adaptation abilities are less proficient.

Now pacing onto the institutions efforts of sustaining globally competitive learners, this will provide recommendations for curriculum enhancement based on the findings, suggesting ways to improve problem-solving, collaboration, and adaptability skills among the learners (Kumar et al., 2023).

## 2. LITERATURE REVIEW

Education 4.0 represents a transformative shift in the field of education, driven by technological advancements and the integration of Industry 4.0 principles into learning environments (Ravindran and Ismail, 2020). The integration of advanced technologies such as artificial intelligence (AI), augmented reality (AR), virtual reality (VR), and the Internet of Things (IoT) is transforming education by providing personalized and immersive learning experiences.

AI is being used in education to create intelligent tutoring systems that adapt to individual learning styles and paces. AI-powered analytics can analyze student performance data to provide insights for targeted interventions (Woolf, 2010). For example, AI algorithms can identify areas where a student might be struggling and offer additional resources or exercises to improve comprehension. AR and VR technologies enhance learning by creating immersive environments. AR overlays digital information onto the physical world, enhancing engagement and interactivity (Dunleavy et al., 2009). VR provides simulated environments that allow students to explore concepts in a hands-on manner, such as virtual field trips or laboratory experiments (Mikropoulos and Natsis, 2011). AR and VR create immersive environments that transport students beyond the classroom. This can include historical reenactments, virtual laboratories, or collaborative problem-solving scenarios that engage multiple senses and enhance retention (Chen et al., 2017).

IoT connects physical objects to the internet, enabling data exchange and automation. In education, IoT can be used for smart classrooms where

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devices interact to enhance learning. For instance, wearable devices could track student engagement, and smart whiteboards could adapt content based on students' preferences (Guillén-Nieto et al., 2018). These technologies enable adaptive learning experiences, tailoring content and assessments to individual students' needs and preferences (Kumar, 2008). AI algorithms analyze learning patterns and customize the learning journey, ensuring that students receive content at their skill level and pace (Baker and Inventado, 2014).

Education 4.0 targets specific skills that need to be developed among the students. Problem-solving skills are critical for individuals to navigate complex situations and find effective solutions (Mayer and Wittrock, 2006). These skills involve the ability to define problems, analyze information, generate and evaluate potential solutions, and make decisions (Jonassen, 2011). Collaboration skills encompass the ability to work effectively with others, communicate ideas, and contribute meaningfully to group efforts (Dillenbourg, 1999). Collaborative learning environments promote social interaction, shared understanding, and co-construction of knowledge (Johnson and Johnson, 1994). Adaptability skills involve the capacity to adjust to new conditions, learn from experiences, and embrace change (Hargrove, 2008). In rapidly changing environments, individuals need to be flexible, open to new ideas, and willing to update their skills (DeLong and Stoller, 2008).

These skills are integrated in education through Problem-Based Learning, collaborative learning strategies and adaptive learning environments. PBL is an educational approach that promotes problem-solving skills by engaging students in real-world challenges (Hmelo-Silver et al., 2007). It encourages critical thinking, collaboration, and self-directed learning. Cooperative and collaborative learning methods enhance collaboration skills by encouraging interaction, shared responsibility, and group achievement (Slavin, 1995). Technology-enabled adaptive learning platforms provide personalized experiences, fostering adaptability as students engage with customized content and learning paths (Brusilovsky et al., 2014).

#### 4. RESULTS AND DISCUSSION

**Table 1: Demographic Profile of the Respondents in terms of Sex, Year Level, and Course**

Sex	f	%
Male	36	31.6
Female	78	68.4
<b>Year Level</b>		
Level 1	47	41.2
Level 2	29	25.4
Level 3	11	9.6
Level 4	27	23.7
<b>Course</b>		
AB Political Science	22	19.3
BA Communication	35	30.7
BS Psychology	57	50.0

The data shows that out of the total students surveyed, 31.6% (36 students) are male, while 68.4% (78 students) are female. With the distribution of students across different year levels, Level 1 with 41.2% (47 students) is

Educational institutions may face challenges in effectively integrating these skills, such as curriculum design, assessment methods, and faculty training. Strategies for overcoming these challenges may involve interdisciplinary approaches, experiential learning, and faculty development programs (Anderson et al., 2001).

#### 3. METHODS

This study employed a quantitative research design through a survey inclusive of 30 statements as indicators targeting levels of proficiency skills in problem solving, collaboration, and adaptability. A total of 114 college students from the College of Arts and Science were selected using convenient sampling from its total population of 153. The data collected from the survey were analyzed using descriptive statistics, such as means and standard deviations and inferential statistics, such as correlation to identify relationships between the variables. The 4-point Likert scale below was used.

Likert Scale	Mean Range	Verbal Description	Verbal Interpretation
4	3.26 - 4.00	Strongly Agree	Very High
3	2.57 - 3.25	Agree	High
2	1.76 - 2.56	Disagree	Moderate
1	1.00 - 1.75	Strongly Disagree	Low

The study stands onto the null hypothesis that there is no significant difference between the respondent's level of proficiency in problem-solving, collaboration, and adaptability skills when they are grouped according to their profile. Leaning towards ethical considerations were informed consents with the researcher's transparency as to purpose and background of the study, respect to voluntary participation, and participant's anonymity.

highest among other levels. Lastly, the data presents the distribution of students across different courses with BS Psychology, the highest among others with 50.0% (57 students).

**Table 2: Levels of Proficiency in Problem-Solving Skills**

Problem Solving Skills	Mean	VI
I am able to identify the problem clearly and define it in a meaningful way.	3.27	Very High
I am able to generate multiple solutions to a problem.	3.21	High
I am able to evaluate the pros and cons of different solutions to a problem.	3.36	Very High
I am able to choose the best solution to a problem based on careful evaluation.	3.36	Very High
I am able to implement the chosen solution effectively.	3.18	High
I am able to reflect on the problem-solving process and identify ways to improve it.	3.28	Very High
I am able to adapt my problem-solving approach to different types of problems.	3.19	High
I feel confident in my problem-solving skills.	2.96	High
I feel that my problem-solving skills have improved over time.	3.24	High
I believe that problem-solving skills are important for success in my academic and professional pursuits.	3.63	Very High
<i>Overall</i>	<i>3.27</i>	<i>Very High</i>

Legend: 3.26-4.00 Very High      2.57-3.25 High      1.76-2.56 Moderate      1.00-1.75 Low

The table shows that respondents, on average, possess high level of proficiency (*Overall Mean=3.27*) in terms of problem-solving skills. They can clearly identify problems, generate multiple solutions, evaluate their pros and cons, choose the best solution through careful evaluation,

implement chosen solutions effectively, reflect on the problem-solving process, and adapt their approach to different types of problems. However, they do not feel highly confident in their problem-solving abilities.

Table 3: Levels of Proficiency in Collaboration Skills		
Collaboration Skills	Mean	VI
I am able to communicate effectively with my team members.	3.28	Very High
I am able to listen actively and attentively to my team members.	3.60	Very High
I am able to contribute my ideas and opinions in a constructive manner.	3.31	Very High
I am able to give and receive feedback in a respectful and supportive way.	3.51	Very High
I am able to identify my strengths and weaknesses as a team member.	3.41	Very High
I am able to identify the strengths and weaknesses of my team members.	3.28	Very High
I am able to work collaboratively with my team to achieve a common goal.	3.28	Very High
I am able to resolve conflicts effectively and constructively within the team.	3.23	High
I feel that I am a valuable contributor to my team.	3.23	High
I believe that collaboration skills are important for success in my academic and professional pursuits.	3.62	Very High
<i>Overall</i>	<i>3.37</i>	<i>Very High</i>

Legend: 3.26-4.00 Very High      2.57-3.25 High      1.76-2.56 Moderate      1.00-1.75 Low

The table reveals that respondents have a very high level of proficiency (*Overall Mean=3.37*) in terms of collaboration skills. They are able to interact with team members effectively, actively listen, contribute constructive ideas and opinions, give and receive feedback in a respectful manner, recognize their own strengths and weaknesses as team members,

work cooperatively to accomplish shared goals, resolve conflicts within the team in a constructive manner, and believe they are valuable members of their teams. Collaboration abilities, in their opinion, are crucial for both their academic and professional success.

Table 4: Levels of Proficiency in Adaptability Skills		
Adaptability Skills	Mean	VI
I am able to adjust to new situations and environments quickly.	3.16	High
I am able to remain calm and composed in challenging or uncertain situations.	3.19	High
I am able to think creatively and come up with innovative solutions to unexpected problems.	3.14	High
I am able to learn new skills and knowledge quickly and effectively.	3.26	Very High
I am able to adapt my communication style to different types of people and situations.	3.35	Very High
I am able to work effectively with people from diverse backgrounds and cultures.	3.33	Very High
I am able to accept feedback and adjust my approach accordingly.	3.45	Very High
I am able to embrace change and see it as an opportunity for growth and development.	3.52	Very High
I feel that my adaptability skills have improved over time.	3.41	Very High
I believe that adaptability skills are important for success in my academic and professional pursuits.	3.68	Very High
<i>Overall</i>	<i>3.35</i>	<i>Very High</i>

Legend: 3.26-4.00 Very High      2.57-3.25 High      1.76-2.56 Moderate      1.00-1.75 Low

On average, the table reveals that respondents possess very high level of proficiency in terms of adaptability skills. They can quickly adapt to new situations and environments, maintain composure in stressful or uncertain circumstances, think creatively and find novel solutions to unexpected problems, learn new skills and knowledge effectively, adapt their communication style to different people and situations, work well with people from different backgrounds and cultures, accept criticism and change their approach as necessary, see change as an opportunity for

growth, and they think that their success in school and in work depends on their capacity to adapt.

Looking at the overall results of the levels of proficiency in problem solving, collaboration, and adaptability skills, this is a positive indication that the opportunities given to students across courses, programs, and extra-curricular activities were directing unto the efforts of the institution to develop lifelong learners.

Table 5: Significant difference between the respondent's level of proficiency in problem-solving, collaboration, and adaptability skills when grouped according to their sex					
	Mean	Mean Difference	t-value	p-value	Verbal Interpretation
Problem-Solving	3.2389	-.04188	-.442	.661	NS
	3.2808				
Collaboration	3.3139	-.08996	-.936	.354	NS
	3.4038				
Adaptability	3.3750	.03782	.426	.672	NS
	3.3372				

In summary, based on the given data and statistical analysis, there is no statistically significant difference (NS) in problem-solving, collaboration,

and adaptability proficiencies between the two groups.

**Table 6:** Significant difference between the respondent's level of proficiency in problem-solving, collaboration, and adaptability skills when grouped according to their year level

		Mean	SD	F-value	p-value	Verbal Interpretation
Problem-Solving	Level 1	3.2000	.44429	2.197	.092	NS
	Level 2	3.2414	.34694			
	Level 3	3.2091	.43921			
	Level 4	3.4370	.34546			
Collaboration	Level 1	3.2596	.44068	<b>3.788</b>	<b>.012</b>	<b>S</b>
	Level 2	3.3345	.37917			
	Level 3	3.4818	.47290			
	<b>Level 4</b>	<b>3.5778</b>	<b>.35554</b>			
Adaptability	Level 1	3.2723	.39601	2.676	.051	NS
	Level 2	3.3103	.36776			
	Level 3	3.3455	.35599			
	Level 4	3.5259	.37682			

The table reveals that there is also no significant difference between the students' level of proficiency in problem-solving and adaptability skills when they are grouped according to their year level. The findings revealed that in problem solving ( $F=2.197$ ,  $p=.092$ ) and adaptability ( $F=2.676$ ,  $p=.051$ ) indicating that the level of proficiency does not significantly vary regardless of their year level. This analysis failed to reject the null hypothesis of no significant difference. However, in collaboration area, there is significant difference when grouped according to the year level

( $F=3.788$ ,  $p=.012$ ) wherein Level 4 has the highest collaboration skills. These findings are similar to related study suggesting that as the grade levels of the participating students increase, their 21st century skills and their tendency to portray development of these skills significantly increase, hand in hand (Ozturk, 2023). Likewise, in a study done where results revealed how students' skills improved as they progressed in their studies particularly those skills related to adaptability and decision-making by (De Prada et al., 2022).

**Table 7:** Significant difference between the respondent's level of proficiency in problem-solving, collaboration, and adaptability skills when grouped according to their courses.

		Mean	SD	F-value	p-value	Verbal Interpretation
Problem-Solving	AB Political Science	3.3182	.36074	.867	.423	NS
	BA Communication	3.3171	.41479			
	BS Psychology	3.2175	.41538			
Collaboration	AB Political Science	3.4591	.32610	1.748	.179	NS
	BA Communication	3.4429	.41677			
	BS Psychology	3.3018	.45571			
Adaptability	AB Political Science	3.3955	.31393	<b>3.218</b>	<b>.044</b>	<b>S</b>
	<b>BA Communication</b>	<b>3.4629</b>	<b>.36306</b>			
	BS Psychology	3.2614	.41480			

The table reveals that there is also no significant difference between the students' level of proficiency in problem-solving and collaboration skills when they are grouped according to their courses. The findings revealed that in problem solving ( $F=.867$ ,  $p=.423$ ) and collaboration ( $F=1.748$ ,  $p=.179$ ) indicating that the level of proficiency does not significantly vary regardless of their courses. This analysis failed to reject the null hypothesis of no significant difference. On the other hand, in adaptability area, there is significant difference when grouped according to the year level ( $F=3.218$ ,  $p=.044$ ) wherein BA Communication course has the highest adaptability skills. A similar study conducted with students from College of Arts and Sciences supporting this found out that the respondents have a "very good" 21st century skills along creativity and innovation, critical thinking and problem solving, communication and collaboration (Aguila, 2015). Furthermore, it is agreeable as the course of BA Communication implies well-developed soft skills like communication, interpersonal, critical thinking and problem-solving as a result to their core competencies that are targeted to be developed by Higher Education Institutions (HEI) throughout the years of learning.

## RECOMMENDATIONS

With the aim to better prepare students for Education 4.0 and the evolving demands of the modern workforce, it is recommended for future curriculum enhancements to use role-playing scenarios where students need to tackle and resolve specific problems, assign different roles, and simulate real-life situations; problem-based learning where learners are presented with real-world problems or complex scenarios that require critical thinking and analysis. Encourage learners to explore multiple solutions, apply knowledge from different subjects, and evaluate the pros and cons of each approach. Likewise, facilitate discussions and guide

students towards effective problem-solving strategies. It is also recommended to increase a collaborative learning approach which focuses on supportive environment and student autonomy within the lower year levels. Anchored upon experiences, learners are likely to listen to each other, cooperate, support, and manage diversity to face difficulties in the learning process as they work together. Lastly, integrate cross-disciplinary collaboration activities that encourage students from different disciplines to collaborate on projects and assignments. This promotes exposure to diverse perspectives, enhances communication and interpersonal skills, and fosters adaptability by navigating different working styles and approaches.

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