

Learners' Attributes on Mathematical Skills and Performance in General Math

Maureen A. Larios

maureen.larios@deped.gov.ph

Laguna State Polytechnic University Sta. Cruz Laguna 4009 PHILIPPINES

Abstract

The study sought to determine the relationship of the learners' attributes on mathematical skills and performance in general math of the one hundred twenty-four (124) senior high school students at Masaya Integrated National High School in Bay, Laguna and considered the result as basis for improving educational programs in the educational setting. In particular, it described profile of the respondents, the level of learners' attributes in terms of learning style, learning space, study habits, independent learning, self-awareness, and self-concept, the level of students' mathematical skills as to reasoning, analytical thinking, problem solving, and critical thinking, and the level of students' performance in general mathematics with regards to grades. Using total enumeration sampling design a survey questionnaire was given to the respondents. The study is a descriptive-correlational research design. Mean, standard deviation, and Pearson product moment of correlation were used to analyze the statistical data gathered in the study. Based on the findings of the study, the following conclusions were drawn: The hypotheses that (1) there is no significant relationship between learners' attributes and mathematical skills is rejected; and (2) there is no significant relationship between learners' attributes and academic performance in general mathematics is also rejected. Thus, learners' attributes have a positive correlation to the students' mathematical skills. Also, learners' attributes have a positive correlation to the performance in general mathematics of the students. The results recommend that teachers may use varied approaches in teaching and learning process and students may still improve their skills to have a higher level of mathematical skills and gain better performance in math.

Keywords: analytical thinking, correlation, critical thinking, independent learning

1. Introduction

The mathematics subject affects all aspects of human life on different levels. Research shows that mathematics is the science of size and numbers, and is very useful in virtually any subject. This is because all areas of research rely on problem solving and predicting outcomes. Among the subjects, mathematics has been regarded as the most difficult which educators considered all factors that may affect the performance of the students. Studies have shown that quality of instruction, environment, strategies in teaching and learning are significantly related to the mathematical performance of the students. However, learners' attributes such as learning style, learning space, study habits, independent learning, self-awareness, and self-concept are some characteristics of the learners that may contribute to improve their mathematical skills and performance in mathematics.

Learning style refers to how students learn using audio, visual, and tactile techniques. This implies that learning takes place when a learner wants to study using audio, charts, graphics, or manipulatives. Learning space refers to conducive environment where the students learn mathematics and the physical setting or a place in which teaching and learning occur. This characterizes the physical atmosphere of the learning process. Study Habits pertains to the routine of the students in learning Mathematics and how it helps them organize their efforts to solve problems, develop skills, and acquire knowledge. Independent learning is a self-directing to learn a skill. It involves management of oneself. Self-awareness refers to the ability the students to focus on themselves and how their actions, thoughts, or emotions do or don't align with their own standards. Self-concept is the student's individual belief about himself or herself, including the person's attributes, and who and what their self is.

Student's mathematical skills in this study includes the reasoning skill, analytical thinking, problem solving, and critical thinking skill. Reasoning skill denotes the students' skills on the process of thinking about something in a logical way in order to form a conclusion or judgment. Analytical thinking refers to the ability of the students to identify and define problems, and extract key information and develop workable solutions in order to develop solutions to resolve the problems identified. Problem solving skill refers to the act of the students in defining a problem, determining its cause, identifying, prioritizing, and selecting alternatives for a solution, and implementing a solution. Critical thinking skill means the students' kind of thinking in which they question, analyze, interpret, evaluate and make a judgment about what they read, hear, say, or write. Performance in General Mathematics refers to the grades of Senior High School students in General Mathematics during the 1st semester, SY 2022-2023.

These factors that hinder conceptual understanding of Mathematics and the challenges they present must therefore be addressed. This allows teachers to modify their teaching approach to meet the learning needs of senior high school students. This enables students to think critically and analytically and apply what they learn to solve real-world problems.

The researcher aimed to examine the relationship between the learners' attributes and the mathematical skills and performance in Mathematics among Senior High School students in Masaya Integrated National High School, Bay, Laguna.

1.1 Objectives

This study aims to determine the relationship of the learners' attributes on their mathematical skills and performance in general mathematics.

Specifically, it seeks answers to the following questions:

1. What is the level of learners' attributes of in terms of:
 - 1.1 learning style;
 - 1.2 learning space;
 - 1.3 study habits;
 - 1.4 independent learning;
 - 1.5 self-awareness; and
 - 1.6 self-concept?
2. What is the level of students' mathematical skills as to:
 - 2.1 reasoning;
 - 2.2 analytical thinking;
 - 2.3 problem solving; and
 - 2.4 critical thinking?
- 3 What is the level of the students' performance in general mathematics in terms of grade?
4. Is there a significant relationship between learners' attributes and students' mathematical skills?

5. Is there a significant relationship between the learners' attributes and the students' performance in general mathematics?

2. Methodology

The descriptive-correlational method of research was used in the study to determine the significant relationship of the learners' attributes on the students' mathematical skills and the performance in general mathematics. The researcher-made questionnaire was used in the study which indicated corresponding perception for them using Likert scale with 1- always, 2- often, 3-seldom, 4-never. The data were gathered and put in the table, analyzed, and interpreted. Finally, making the generalization of the study.

A total enumeration sampling design was used to determine the significant relationship of the learners' attributes and students' mathematical skills, and also the significant relationship of the learners' attributes and mathematical performance in terms of general mathematics grade by 124 grade 11 respondents at Masaya Integrated National High School in Barangay Masaya, Bay, Laguna. In this study, the Pearson correlation formula was computed to determine the significance in its quantitative relation to learners' attributes, mathematical skills, and general mathematics grade.

3. Results and Discussion

In this study data were gathered from 124 grade 11 senior high school students as respondents.

Table 1. Level of Learners' Attributes in terms of Learning Style

Statements	Mean	SD	Remarks
1. When trying to remember the lessons in math, it helps me to get a picture of it in my mind.	3.75	0.95	Often
2. I understand how to do something in math if someone tells me, rather than having to read the same thing to myself.	3.84	0.94	Often
3. Before I follow directions in math, it helps me to see someone else do it first.	3.74	1.02	Often
4. In math, it is better for me to get work done in a quiet place.	4.21	0.90	Always
5. I think better in math when I have the freedom to move around.	3.77	1.07	Often
Total	3.86	0.75	High

Legend:

4.21 – 5.00 Always

3.41 – 4.20 Often

2.61 – 3.40 Seldom

1.81 – 2.60 Rarely

1.00 – 1.80 Never

Table 1 revealed the students' level of learners' attributes in terms of learning style. The respondents *always* feel comfortable when they work in a quiet place ($M=4.21$, $SD=0.90$). They *often* understand how to do something in math, if someone guides them, rather than read the same thing on their own ($M=3.84$, $SD=0.94$). On the other hand, students *often* follow direction in math, if there's someone to do first it for them ($M= 3.74$, $SD= 1.02$)

The overall mean of 3.86 indicates that the level of learners' attributes in terms of learning style is

high. This means that the learners can perform better when they are aware of their learning style. They are more capable of performing processes, concepts, and retain information when they follow their style of learning. Learning styles can be visual, audio, manipulative, or through reading materials. It is important that a learner knows how she learns better through the manifestation of his learning style.

Table 2. Level of Learners' Attributes in terms of Learning Space

Statements	Mean	SD	Remarks
1. I have a flexible space for activities during math activities	3.65	0.90	Often
2. I can freely move myself in our math classroom.	3.60	1.02	Often
3. I can focus in our lesson in math with the lightning provided.	3.73	0.97	Often
4. I understand my math lesson at the room temperature I have.	3.67	0.93	Often
5. I can easily collaborate in my math groupings with my classmates .	3.82	1.09	Often
Total	3.69	0.79	High

Legend:

4.21 – 5.00 Always

3.41 – 4.20 Often

2.61 – 3.40 Seldom

1.81 – 2.60 Rarely

1.00 – 1.80 Never

Table 2 displays that the respondents *often* easily collaborate in the math groupings with their classmates (M= 3.82, SD= 1.09). They *often* focus on math with lightning provided (M= 3.73, SD= 0.97). However, they *often* freely move themselves in their math classroom (M= 3.60, SD= 1.02).

The overall mean of 3.69 indicates that the level of learners' attributes in terms of learning space is *High*. This means that learning space is important to consider in every teaching and learning process as it regulates the mental development of every learner. Learning space regulates better cognitive process when learners are able to take their own actions in the desired conducive environment. Ventilation, number of students, and room temperature in mathematics class are some points to consider.

Table 3. Level of Learners' Attributes in terms of Study Habits

Statements	Mean	SD	Remarks
1. I set aside a regular time for studying every day.	3.78	0.94	Often
2. I try to record/remember everything a teacher discusses in class.	3.87	1.02	Often
3. Before I leave class, I make sure that I know what homework to do and how to do it.	4.12	0.96	Often
4. I check my lecture notes to review for the lessons.	4.14	0.89	Often
5. Before I begin an assignment, I estimate how long it will take me to finish it and then try to beat the clock.	3.72	1.10	Often
Total	3.93	0.74	High

Legend:

4.21 – 5.00 Always

3.41 – 4.20 Often

2.61 – 3.40 Seldom

1.81 – 2.60 Rarely

1.00 – 1.80 *Never*

Table 3 demonstrates that respondents *often* check their lecture notes to review for the lessons (M= 4.14, SD= 0.89). They *often* make sure that they know what to do and how to do their homework before leaving the class (M= 4.12, SD= 0.96). On the other hand, they *often* estimate how long will take them to finish their assignment and then try to beat the clock (M= 3.72, SD= 1.10).

The overall mean of 3.93 shows that the learners' attributes in terms of study habits is *High*. This means that study habits is a condition that every learner should be well-equipped as they go up to the next level of their academic aspect. It should be developed, monitored, and be maintained. Learners can perform better academically when they possess this kind of attribute.

Table 4. Level of Learners' Attributes in terms of Independent Learning

Statements	Mean	SD	Remarks
1. I can accurately assess my own learning ability.	3.74	0.94	Often
2. I am more confident in my ability to self-assess my learning progress.	3.72	0.97	Often
3. The amount of feedback from my teacher is appropriate.	4.02	0.91	Often
4. I recognize that if I'm stuck in certain difficult lessons, I change my strategy.	3.79	0.89	Often
5. I maintain concentration while studying.	3.99	0.93	Often
Total	3.85	0.76	High

Legend:

4.21 – 5.00 *Always*

3.41 – 4.20 *Often*

2.61 – 3.40 *Seldom*

1.81 – 2.60 *Rarely*

1.00 – 1.80 *Never*

Table 4 exhibits that the respondents *often* view that the amount of feedback from their teacher is appropriate (M= 4.02, SD= 0.91). They *often* maintain concentration while studying (M= 3.99, SD= 0.93). However, the students are more *often* confident in their ability to self-assess their learning progress (M= 3.72, SD= 0.97).

The overall mean of 3.85 shows that the learners' attributes in terms of independent learning is *High*. This indicates that independent learning is a matter of cognition that is important for every learner to learn and nurture. Perhaps, a teachers' appreciation or recognition of the work of the learners may contribute to their independence.

Table 5. Level of Learners' Attributes in terms of Self Awareness

Statements	Mean	SD	Remarks
1. I am aware of the behavior that I show all the time	4.07	0.96	Often
2. I am aware of the emotions that I feel all the time	3.96	1.03	Often
3. I can identify the causes why I feel negative emotions.	3.81	1.06	Often
4. I can tell the patterns of emotions that I feel the most.	3.85	0.94	Often
5. I can reflect upon my actions and learn from them	4.02	0.96	Often
Total	3.94	0.78	High

Legend:

4.21 – 5.00 *Always*

3.41 – 4.20 *Often*
 2.61 – 3.40 *Seldom*
 1.81 – 2.60 *Rarely*
 1.00 – 1.80 *Never*

Table 5 reveals that the respondents are *often* aware of their behavior that they show all the time ($M=4.07$, $SD=0.96$). They *often* reflect upon their actions and learn from them ($M=4.02$, $SD=0.96$). However, they *often* can identify the causes why they feel negative emotions ($M=3.81$, $SD=1.06$).

The overall mean of 3.94 shows that the learners' attributes in terms of self-awareness is *High*. This indicates that learners' are aware of their behaviors during math class. They know which of their solutions would contribute or not in their academic development. Journals and/ or blogs are some modes used by students to show their self-awareness in their behaviors.

Table 6. Level of Learners' Attributes in terms of Self Concept

Statements	Mean	SD	Remarks
1. I consider myself to be a very uptight and highly motivated person	3.78	0.95	Often
2. To do anything, I first need other people's approval.	3.81	0.95	Often
3. I am a man/woman of my word.	4.22	0.92	Always
4. I feel different from most people and wish I was more like them.	3.69	1.26	Often
5. I have trouble taking criticism from other people.	3.31	1.21	Seldom
Total	3.76	0.69	High

Legend:

4.21 – 5.00 *Always*
 3.41 – 4.20 *Often*
 2.61 – 3.40 *Seldom*
 1.81 – 2.60 *Rarely*
 1.00 – 1.80 *Never*

Table 6 displays that the respondents are *always* men/women of their word ($M=4.22$, $SD=0.92$). They are *often* reminded that to do anything, they first need other people's approval ($M=3.81$, $SD=0.95$). On the other hand, they *seldom* have trouble taking criticism from other people ($M=3.31$, $SD=1.21$).

The overall mean of 3.76 shows that the learners' attributes in terms of self-concept is *High*. This indicates that learners are keeping themselves aware of the totality of what others might tell them on their mathematical skills or how feedback might affect them in learning mathematics.

Table 7. Level of Students' Mathematical Skills in terms of Reasoning Skills

Statements	Mean	SD	Remarks
1. I can make a consideration in developing mathematical situations.	3.72	0.88	Often
2. I can connect the existing mathematical knowledge to previous experience.	3.68	0.88	Often
3. I have an ability to make logical links and connections with the help of new math problems.	3.60	0.89	Often
4. I am equipped with the reasoning ability to work out an answer to the given math problem.	3.66	0.91	Often

5. I can make a consideration in developing mathematical situations.	3.72	0.88	Often
Total	3.68	0.73	High

Legend:

4.21 – 5.00 Always
 3.41 – 4.20 Often
 2.61 – 3.40 Seldom
 1.81 – 2.60 Rarely
 1.00 – 1.80 Never

Table 7 displays that the respondents *often* draw conclusions based on the given problem. (M= 3.75 , SD= 0.82). They *often* make a consideration in developing mathematical situations (M=3.72, SD= 0.88). Nonetheless, they often have the ability to make logical links and connections with the help of new math problems (M= 3.60, SD= 0.89).

The overall mean of 3.68 shows that the learners' attributes in terms of reasoning skill is *High*. This shows that learners can give a conclusion or final answer when word problems are given during math class. It seems that learners have the tendency to easily draw a conclusion when they are practicing solving parallel word problems.

Table 8. Level of Students' Mathematical Skills in terms of Analytical Skills

Statements	Mean	SD	Remarks
1. I identify first the given information of a given math problem.	3.94	0.94	Often
2. I develop solutions to check and observe the impact on word problem.	3.76	0.90	Often
3. I apply new knowledge to test if it works in a given word problem.	3.90	0.91	Often
4. I review my solutions to check if there is a mistake in the process.	3.99	0.95	Often
5. I look forward on the improvement of my math skills.	4.06	0.93	Often
Total	3.93	0.77	High

Legend:

4.21 – 5.00 Always
 3.41 – 4.20 Often
 2.61 – 3.40 Seldom
 1.81 – 2.60 Rarely
 1.00 – 1.80 Never

Table 8 states that the respondents *often* look forward to the improvement of their mathematics skills (M= 4.06, SD= 0.93). Students *often* review their solutions to check if there is a mistake in the process (M= 3.99, SD= 0.95). Meanwhile, They *often* develop solutions to check and observe the impact on word problems (M= 3.76, SD= 0.90).

The overall mean of 3.93 shows that the students' mathematical skills in terms of analytical skill is *High*. This displays that learners have a positive attitude that they will improve their mathematics skills as they learn math concepts and apply these into everyday lives.

Table 9. Level of Students' Mathematical Skills in terms of Problem-Solving Skills

Statements	Mean	SD	Remarks
1. I understand the word problem easily.	3.52	0.88	Often
2. I critically analyze the given numerical information.	3.76	0.90	Often
3. I apply the equation suited to the given word problem.	3.69	0.95	Often
4. I develop logical analysis on how the execute the mathematical equation.	3.56	0.93	Often
5. I describe the solution using unit of measure.	3.53	0.88	Often
Total	3.60	0.76	High

Legend:

4.21 – 5.00 Always

3.41 – 4.20 Often

2.61 – 3.40 Seldom

1.81 – 2.60 Rarely

1.00 – 1.80 Never

Table 9 demonstrates that the respondents' *often* critically analyze the given numerical information (M= 3.70, SD=0.82). They *often* apply the equation suited to the given word problem (M= 3.69, SD= 0.95). Nonetheless, They *often* understand the word problem easily (M= 3.52, SD=0.88).

The overall mean of 3.60 displays that the students' mathematical skills in terms of problem-solving skill is *High*. This implies that learners are able to solve word problems when they apply the given methods in solving. There are different strategies exposed or discovered in solving word problems that take reasoning skill. They need to discover the mathematical equation in order to solve for the final answer.

Table 10. Level of Students' Mathematical Skills in terms of Critical Thinking Skills

Statements	Mean	SD	Remarks
1. I recognize the pattern or relationship of numbers/problems in math.	3.67	0.91	Often
2. I can evaluate given the value of a function/ formula in math.	3.59	0.88	Often
3. I can identify given information and unknown in a word problem.	3.56	0.90	Often
4. I can evaluate an effective solution to the given word problem in math.	3.61	0.90	Often
	3.60	0.79	Often
5. I am able to draw conclusions based on the given information in a number/word problem.	3.70	0.79	Often
Total	3.60	0.76	High

Legend:

4.21 – 5.00 Always

3.41 – 4.20 Often

2.61 – 3.40 Seldom

1.81 – 2.60 Rarely

Table 10 reveals that the respondents' *often* recognize patterns or relationship of numbers/problems in mathematics ($M=3.67$, $SD=0.91$). They *often* evaluate an effective solution to the given word problem in mathematics ($M= 3.61$, $SD= 0.90$). On the other hand, The *often* identify given information and unknown in a word problem ($M= 3.56$, $SD= 0.90$).

The overall mean of 3.60 displays that the students' mathematical skills in terms of critical thinking skill is *High*. This entails that learners may find patterns or connections between two quantities. They look at the mathematical rule that relates to the word problems given to them. They understand the problems when they know some models are presented.

Table 11. Level of Learners' Performance in General Mathematics in terms of grades

FIRST QUARTER	MEAN	SD	REMARKS
Quarter 1	85.42	4.22	Closely Approaching Mastery
Quarter 2	87.32	4.28	Closely Approaching Mastery
Weighted mean	86.60		
SD	3.99		
Verbal Interpretation Closely Approaching Mastery			

Table 11 entails the respondents' mean average in the first quarter grade in general mathematics ($M= 85.42$, $SD= 4.22$), while the mean average in second quarter grade ($M=87.32$, $SD= 4.28$). With the one hundred twenty-four (124) respondents, the mean grade in the first semester is 86.60 and a standard deviation of 3.99. It signifies that the mastery achievement level is closely approaching.

Table 12. Correlation on Learners' Attributes and Students' Mathematical Skills

Learners' Attributes	Students' Mathematical Skills	r- value	Correlation Interpretation	p-value	Analysis
Learning Style	Reasoning Skill	.467**	Moderate Correlation	.000	Significant
	Analytical Skill	.431**	Moderate Correlation	.000	Significant
	Problem-Solving Skill	.394**	Low Correlation	.000	Significant
	Critical Thinking Skill	.288**	Low Correlation	.000	Significant
Learning Space	Reasoning Skill	.542**	Moderate Correlation	.000	Significant
	Analytical Skill	.504**	Moderate Correlation	.000	Significant
	Problem-Solving Skill	.473**	Moderate Correlation	.000	Significant
	Critical Thinking Skill	.465**	Moderate Correlation	.000	Significant

Study Habits	Reasoning Skill	.473**	Moderate Correlation	.000	Significant
	Analytical Skill	.531**	Moderate Correlation	.000	Significant
	Problem-Solving Skill	.449**	Moderate Correlation	.000	Significant
	Critical Thinking Skill	.411**	Moderate Correlation	.000	Significant
Independent Learning	Reasoning Skill	.666**	High Correlation	.000	Significant
	Analytical Skill	.647**	High Correlation	.000	Significant
	Problem-Solving Skill	.594**	Moderate Correlation	.000	Significant
	Critical Thinking Skill	.510**	Moderate Correlation	.000	Significant
Self-Awareness	Reasoning Skill	.436**	Moderate Correlation	.000	Significant
	Analytical Skill	.509**	Moderate Correlation	.000	Significant
	Problem-Solving Skill	.399**	Low Correlation	.000	Significant
	Critical Thinking Skill	.385**	Low Correlation	.000	Significant
Self- Concept	Reasoning Skill	.574**	Moderate Correlation	.000	Significant
	Analytical Skill	.474**	Moderate Correlation	.000	Significant
	Problem-Solving Skill	.559**	Moderate Correlation	.000	Significant
	Critical Thinking Skill	.484**	Moderate Correlation	.000	Significant

Significant at 0.05 (2 tailed), n=124

Table 12 shows correlation on learners' attributes and students' mathematical skills. In terms of independent learning, both reasoning and analytical skills have *high positive correlation* with learners' attributes as indicated with ($r = .666$, $p = .000$) and ($r = .647$, $p = .000$), respectively. These correlations are significant, suggesting that when students learn on their capabilities, their reasoning and analytical skills in the subject of General Mathematics are positively impacted.

Conversely, for learning style, problem-solving and critical thinking skills exhibit *low positive correlation* with learners' attributes with ($r = .394$, $p = .000$) and ($r = .288$, $p = .000$), respectively. These correlations are significant and suggest that when students employ their own learning style, there is a low positive impact on their problem solving and critical thinking skills on the subject.

Overall, the results indicate that learners' attributes has a significant *positive relationship* with students' mathematical skills. These correlations observed in the study suggest that when students effectively develop their attributes, it will enhance their mathematical skills.

Table 13. Correlation on Learners' Attributes and Performance in General Mathematics in terms of Grades

Learners' Attributes	Performance in General Mathematics	r- value	Correlation Interpretation	p-value	Analysis
Learning Style	Grade	.183**	Very low correlation	.000	Significant
Learning Space	Grade	.176**	Very low correlation	.000	Significant
Study Habits	Grade	.128**	Very low correlation	.000	Significant
Independent Learning	Grade	.149**	Very low correlation	.000	Significant
Self-Awareness	Grade	.248**	Low Correlation	.000	Significant
Self-Concept	Grade	.032**	Very low correlation	.000	Significant

Significant at 0.05 (2 tailed), n=124

Table 13 shows the significant correlation of the learners' attributes as to performance in general mathematics in terms of grades. In terms of self-awareness, grades in General Mathematics show a *low positive correlation* with learners' attributes as indicated by ($r = .248$, $p = .000$). This correlation is significant and suggests that when students are aware of their behaviors and actions in the subject of General Mathematics, there is a positive impact on their grades.

Likewise, for self-concept, grade exhibits a *very low positive correlation* with learners' attributes with ($r = 0.32$, $p = .000$). This result advises that when students know their feelings and thoughts towards general mathematics, then it will make an impact on their grades.

Overall, the results indicate that learners' attributes have a significant positive relationship with performance in general mathematics in terms of grades. The correlations observed in the study suggest when students develop their attributes it will enhance performance in General Mathematics in terms of grades.

4. Conclusion and Recommendations

In conclusion to this study, the following were obtained: First, the learners' attributes have a significant positive relationship with students' mathematical skills. So, the first hypothesis is rejected. Likewise, learners' attributes have a significant positive relationship with performance in general mathematics in terms of grades. Thus, the second hypothesis is also rejected. Furthermore, the study disproves the null hypotheses and found that there is a significant relationship between learners' attributes and students' mathematical skills; and there is a significant relationship between learners' attributes and performance in general mathematics

Based on the findings and conclusions of the study, the recommendations are

1. Students may still improve their skills in independent learning in order for them to have a higher level of mathematical skills and gain better performance in math. Students may also enhance their level of self-awareness through joining seminars, training, work-shops, and also with other related activities.

2. Teachers may use varied approaches and strategies in teaching and learning process to enhance the learners' attributes, mathematical skills, and academic performance in mathematics. Since all of the learners' attributes were examined, developmental programs in mathematics would be implemented to improve skills and performance.

3. Future researchers may determine the relationship between the respondents' profile and learners' attributes, respondents' profile and mathematical skills, or respondents' profile and academic performance. Further study may be conducted to include variables that may be related to learners' attributes such as motivations, interests, or leadership skills.

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