

Twenty First (21st) Century Skills and Student Mathematics Performance in Self-Blend Approach

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Abstract:

This study investigated the twenty first (21st) century skills and student mathematics performance in self-blend approach (SBA). The research findings showed that the students have low performance in their pretest, and moderate performance in both posttest and retention test. Students have high 21st century skills before and after the intervention. Results indicated that students exposed to SBA have performed better than students who were exposed to non-self-blend approach (non-SBA) in terms of post-test and retention test scores. There is a significant difference in the level of 21st century skills of the students who were exposed to the SBA and that of students exposed to the non-SBA in terms of critical thinking and problem solving, motivation and work ethics, ethics and integrity, persistence and resilience, leadership and teamwork, and communication skills.

Key Words: mathematics performance, self-blend approach, 21st century skills

Introduction

Mathematics utilizes information to represent solving problem situations in all disciplines. It is an interdisciplinary expanse with a powerful set of tools to understand the world. It is said to be the foundation in almost all aspects in academics given its significance in education and all careers. With this, it's a necessity to have enough amount of competence in mathematics for the purposes of world's improvement.

However, questions on how this mathematical competence will be realized, how this mathematical perception will retain after a series of lessons encountered by the students, or how the students learn all the mathematical concepts and procedures for the past several years according to Duque and Tan (2018). Since there are lots of reasons of how the performance of the students are affected, to name a few, environmental factors (Andamon & Tan, 2018), sociological factors (Cordova & Tan, 2018), students' motivations and self-efficacy (Saligumba & Tan, 2018; Saligumba & Tan, 2019), teaching processes and strategies (Tan-Ucang & Tan, 2013; Asparin & Tan, 2018; Aguanta & Tan, 2018; Dagoc & Tan, 2018; Guita & Tan, 2018; Segumpan & Tan, 2018; Salingay & Tan, 2018; Tan, 2018; Tan & Limjap, 2018), and assessments (Pagtulon-an & Tan, 2018; Tan et al., 2019; Tan, Cordova & Ucang, 2018) are some of the factors affecting children in learning efficiently the context of mathematics.

There is a need to emphasize those reasons to minimize the decreasing rate in mathematical skills of the students. Regardless of a lot of creative teaching strategies developed today, and even though Mathematics is an interesting subject for some, majority of the students find the subject difficult, frightening and discouraging, and so, Mathematics performance remains low. In fact, mathematics teachers of Valencia Baptist Christian Academy (VBCA) are encountering with the actuality that the students do not fully grasp the mathematical concept or procedures introduced. It is evident on the National Achievement Test (NAT) that the result is very low particularly in the field of mathematics for having 28.7% rank which is the lowest among all subjects for the school year 2014-2015. This shows that students really do not achieve mastery level of understanding in the field of mathematics since it did not make it to the passing rate set by the National Educational Testing and Research Center (NETRC).

Moreover, knowledge itself is developing ever more specialized and growing exponentially. Information and communication technology is transforming how we learn social relationships. Work ethics, persistence, shared decision-making, information sharing, collaboration, innovation, motivation and speed is important in today's enterprises. Today, much success lies in being able to communicate, share, and use information to solve complex problems, in being able to adapt and innovate in response to new demands and changing circumstances, in being able to command and expand the power of technology to create new knowledge.

Hence, new standards for what students should be able to do are replacing the basic skill competencies and knowledge expectations of the past. To meet these challenge teachers, teachers' instruction and schools must be transformed in ways that will enable students to acquire the creative thinking, flexible problem solving, collaboration and innovative skills they will need to be successful in work and life. The desire of every educator is to see that learners achieve greater in their future career, comprise skills, abilities and learning dispositions as being identified and as being required in twenty first (21st) century society and workplace. It is associated with deeper learning, as students mastering skills such as critical thinking and problem solving skills, motivation and work ethics, ethics and integrity, persistence and resilience, leadership and teamwork, and communication skills. These skills differ from traditional academic skills in that they are not primarily content knowledge based.

Knowledge on how to elevate these skills is important. Teachers should address the needs of the students with the various activities and tasks assigned to them in the classroom and even after class, to supplement learning with any online activities provided by them to cater their individual differences and multiple intelligences in learning process. A type of approaches such as self-blend is meaningful but at the same time manageable and would lead to successful learning outcomes.

It is a big challenge for the mathematics educators to let the student love the subject. Nonetheless, every student is allotted to experience success and achievement in this area. We should help them to improve by making their own effort to learn the subject by themselves using

the available internet connections in their houses. It's their initiative to do research to enhance their learning.

Hence, it gives the researcher an idea to conduct a study on twenty first (21st) century skills, and student mathematics performance in self-blend approach (SBA).

Methodology

The study was conducted at Valencia Baptist Christian Academy (VBCA) located at Sayre highway, Valencia City, Bukidnon. The said school has an estimated population of 800 students from Kindergarten to Senior High School, with 2 sections per grade level. It is a private institution that is supported by the government through giving Fund Assistance in Private Education (FAPE) grantee in all levels in High School. It offers the k to 12 Basic Education Curriculum which provides a solid foundation in Mathematics Education.

Valencia Baptist Christian Academy is more than 25 years in operation; it has been serving the constituents by taking its responsibility in attaining the school mission and vision that are in line with the national educational policies, plans and programs. It has three instructional classroom for kindergarten, ten instructional classrooms for Elementary and eleven instructional classrooms for Junior and Senior High School, one library, one Computer Laboratory, one Audio Visual Room, one House keeping room, one Physical Education room, one Music and Art room, one Science Laboratory room, one TLE Laboratory, one smoke house, one guidance counselling office, one chaplain's office, one registrar's office and one office of the Director that caters the need of the students as part of their development.

The investigation utilized the quasi-experimental type of research in two heterogeneous classes. The experimental group is the group of twenty five (25) students with internet connections in their houses and the control group was those twenty eight (28) students who don't have internet connections in their houses. It would determine the effect of self-blend approach on student mathematics performance and 21st century skills at Valencia Baptist Christian Academy (VBCA) during the Fourth grading period of School Year 2017-2018.

Prior to the conduct of the observation, the researcher passed an ethics statement that was observed from the beginning to the end of the research study. The ethics statement was given to the Principal, class adviser, and the Grade 9 students as the respondents of this study for the School Year 2017-2018.

After obtaining the permission from the Administrator of Valencia Baptist Christian Academy (VBCA), a pre-test was given before the experimental period started while the post-test was administered after the discussion of the topics. Retention test was administered two (2) weeks after the post-test. The students answered a perceived twenty first (21st) century skill items before and after the experimental period. The performance of the students was measured based on their achievements on the teacher-made test.

The Self-blend approach

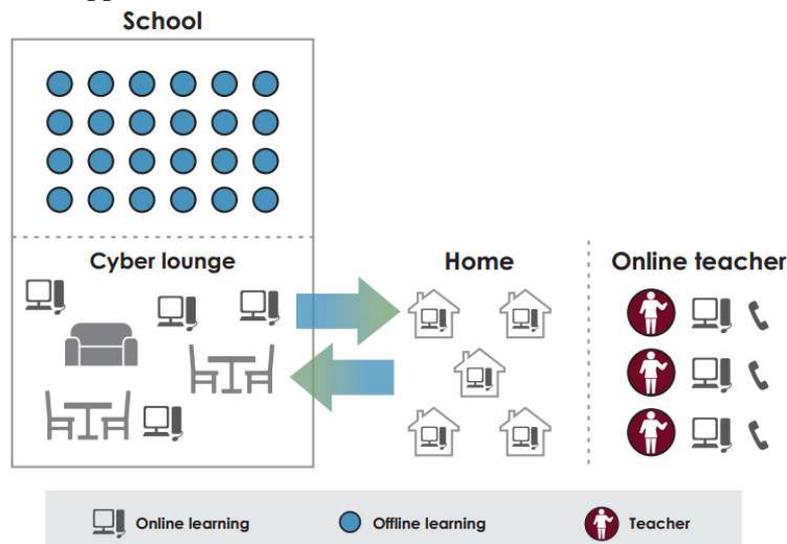


Figure 3. Self-blend model

It is a blended learning that is popular among students and teachers alike because it gives students the freedom to supplement the instruction that happens in the classroom.

A class combined with instruction and taking some portion of their classes online that helps students hone their digital literacy skills, which is important for teenagers who will soon be entering the 21st century workforce. Discussion takes place first to unlock prior knowledge and concepts to the students. After class, online supplementary activities given like videos, worksheets, additional information about the topics was given.

It gives students the opportunities to take classes beyond what is already offered at their school. The individuals attend classes with traditional school environment; they also opt to supplement their learning through online activities and videos. In order for this method to be successful, students must be highly self-motivated. It is ideal for the students who want to take additional advanced placement of progressions. To assure that students are doing their task, they need to post it in the online classroom with their reflection or “what I learned about...”

On the other hand, in a non-SBA class, students were exposed to the traditional way of giving activities. No online supplementary activities were given to students. Discussion takes place first to unlock prior knowledge and concepts to the students. Presentation of the lesson is the same as that of the SBA, however during end of the lesson, the teacher gave only traditional worksheets, and activities as their homework.

The researcher used descriptive statistics such as frequency, mean and standard deviation to describe the level of students' performance, and twenty first (21st) century skills, before and after the self-blend approach.

Analysis of covariance (ANCOVA) was used to determine the significant difference between the perceived 21st century skills, and student mathematics performance in a self-blend approach.

Results

This part presents the results of the investigation. The presentation is arranged based on the order of the objectives of this study.

Mathematics Performance of the Students Exposed to SBA and Non-SBA Group

Table 1. Level of Performance of Students in the Pretest.

Range	GROUP				Qualitative Interpretation
	SBA		Non-SBA		
	F	%	F	%	
90%-100%	0	0	0	0	Very High Performance
86%-89%	0	0	0	0	High Performance
80%-85%	0	0	0	0	Moderate Performance
75%-79%	2	8	1	3.6	Low Performance
65%-74%	23	92	27	96.4	Very Low Performance
MEAN	21.52 22.21				
MPS	69% 69%				Very Low Performance

As shown in Table 1, 2 or 8% of the students exposed to SBA had low performance and 23 or 100% had a very low performance in the pretest. On the other hand, it can be noticed in the non-SBA group that 1 or 3.6% had a low performance and 27 or 96.4% of the students had a very low performance.

The group which was exposed to SBA had a mean score of 21.52 which indicates that students' scores are fairly satisfactory indicating a very low performance. The non-SBA group had a mean score 22.21 which indicates that students' scores are also fairly satisfactory signifying also a very low performance.

The findings confirm the result of Catli (2016) when she found out that the scores of the students in the pretest did not meet the average level of the proficiency. Pagtulon-an and Tan (2018), added that the finding is expected since they do not have a foundation about the topic.

It is evident also to the study of Mbugua, Kiruino and Pell (2012) that mathematics performance of students is persistently low and this poor performance is affected by factors that include under staffing, inadequate teaching/learning materials, lack of motivation and poor attitudes by both teachers and students. Additionally, Tuminaro and Redish (2014) mentioned the

two possible distinct reasons for his poor performance in physics and lack knowledge on how to apply the mathematical skills they have to particular problem situation in physics.

Table 2 presents the level of performance of students in their posttest, frequency, qualitative interpretation and percentage of scores of the students exposed to SBA and non-SBA.

Table 2. Level of Performance of Students in the Posttest.

Range	GROUP				Qualitative Interpretation
	SBA		Non-SBA		
	F	%	F	%	
90%-100%	6	24	1	3.6	Very High Performance
86%-89%	1	4	0	0	High Performance
80%-85%	12	48	15	53.6	Moderate Performance
75%-79%	5	20	6	21.4	Low Performance
65%-74%	1	4	6	21.4	Very Low Performance
MEAN	43.36		39.29		
MPS	84%	Very Satisfactory	79%		Satisfactory

As shown in Table 2, the SBA group had the following performance in the posttest: 1 or 4% of the students had a very low performance; 5 or 20% of the students had a low performance; 12 or 48% of the students had a moderate performance and 1 or 4% of the students had high performance and 6 or 24% had reach the very high performance. On the other hand, in the non-SBA group, 6 or 21.4% of students had a very low performance; 6 or 21.4% of the students had low performance; 15 or 53.6% had moderate performance and 1 or 3.6% of the students had very high performance in the posttest.

Moreover, the SBA group obtained a mean score of 43.36 indicating “moderate performance” result, while the non-SBA group had a mean score of 39.29 which indicates a “low performance” result. Before intervention, most of the students in the SBA and the non-SBA group belong to fairly satisfactory, indicating a very low performance in Mathematics as indicated in Table 1.

The result supports the finding of Pagtulon-an and Tan (2018) when they found that students exposed to different teaching environments increased content in knowledge and higher retention after the treatment.

Table 3 presents the level of performance of students in their retention test, frequency and percentage of scores of the students exposed to SBA and non-SBA.

Table 3. Level of performance of students in retention test.

Range	GROUP				Qualitative Interpretation
	SBA		Non-SBA		
	F	%	F	%	
90%-100%	3	12	1	3.6	Very High Performance
86%-89%	3	12	0	0	High Performance
80%-85%	13	42	10	35.7	Moderate Performance
75%-79%	5	20	8	28.6	Low Performance
65%-74%	1	4	9	32.1	Very Low Performance
MEAN	42.40		37.7 5		
MPS	83%	Very Satisfactory	78%		Satisfactory

On the retention test, in the SBA group 1 or 4% of the students had a very low performance, 5 or 20% of the students had a low performance, 13 or 42% of the students had a moderate performance, 3 or 12% had high performance; and 3 or 12% of the students had a very high performance. In the non-SBA group, 9 or 32.1% of the students had a very low performance, 8 or 28.6% of the students had a low performance, and 10 or 35.7% had a moderate performance; and 1 or 3.6% of the students had a very high performance.

Table 3 also shows the mean scores of the retention test of the students. The SBA group had a mean score of 42.40 which indicates a ‘moderate performance’ result, and the non-SBA group obtained a mean score of 37.75 which indicates a ‘low performance’ result.

Lorenzetti (2018) believed that incorporating blended learning will have a positive impact on retention of the students.

21st Century skills of Students towards Mathematics Before Intervention

Table 4. Summary of perceived 21st century skills of students before Intervention

SKILLS	GROUP			
	Mean	QD	Mean	QD
Critical thinking and problem solving	2.66	Above average	2.63	Above average
Motivation and work ethics	3.18	Above average	3.27	Above average
Ethics and integrity	4.32	Outstanding	4.09	Outstanding
Persistence and reliance	4.10	Outstanding	3.46	Outstanding
Leadership and teamworks	2.90	Above Average	2.91	Above Average
Communication skills	3.07	Above average	3.04	Above average
MEAN	3.37	Above Average	3.23	Above Average

Range	Descriptive Meaning	Qualitative Interpretation
1.00-1.50	Below average	Low
1.51-2.50	Average	Neutral
2.51-3.50	Above average	High
3.51-4.50	Outstanding	Very high
4.51-5.50	Truly exceptional	Outstanding
5.51-6.00	Insufficient opportunity to evaluate	Exceptional

The same finding is true to the study of Pana (2017) where he found out that both groups of students before the integration of the study has the same attitude towards 21st century learning. They are confident that they can do Mathematics which gives them a base of sound thinking in everyday life.

Recent research, mastering content with intervention must come before an attempt to put it to good use. As it turns out, using knowledge acquired with the use of any intervention as it is being learned--- applying skills critical thinking, problem solving, creativity to the content knowledge--- increases motivation and improves learning outcomes (Irfaner, 2006).

Additionally, students have shown positive level on their perceived 21st century skills before any intervention, believing that a solid mathematical knowledge opens more possibilities when selecting a future profession.

21st Century Skills of Students Towards Mathematics After Intervention

Table 5. Summary of perceived 21st century skills of students after Intervention

SKILLS	GROUP			
	Mean	QD	Mean	QD
Critical thinking and problem solving	4.14	Outstanding	4.10	Outstanding
Motivation and work ethics	4.14	Outstanding	3.98	Outstanding
Ethics and integrity	4.60	Truly exceptional	4.34	Outstanding
Persistence and reliance	4.42	Outstanding	4.20	Outstanding
Leadership and teamworks	3.85	Outstanding	3.79	Outstanding
Communication skills	4.07	Outstanding	3.74	Outstanding
MEAN	4.20	Outstanding	4.03	Outstanding

Range	Descriptive Meaning	Qualitative Interpretation
1.00-1.50	Below average	Low
1.51-2.50	Average	Neutral
2.51-3.50	Above average	High
3.51-4.50	Outstanding	Very high
4.51-5.50	Truly exceptional	Outstanding
5.51-6.00	Insufficient opportunity to evaluate	Exceptional

They are also confident that they can do Mathematics which gives them a base of sound thinking in everyday life. Additionally, students also have shown high level on their perception on 21st century skills in believing that a solid mathematical knowledge opens more possibilities when selecting a future profession.

Analysis of Covariance (ANCOVA) of Posttest Results Between Interventions

Table 18 presents the analysis of covariance (ANCOVA) of posttest results between interventions.

As can be observed in the table, the pretest was used as covariate to statistically equate different prognostic variables which may affect the analysis. The F-value between groups is 153.696 with a probability of 0.000 indicating that there is significant difference, thus the null hypothesis that the performance of the students exposed to SBA is non-comparable to performance of students exposed to non-SBA in terms of posttest is rejected.

This implies that SBA group with a mean of 43.36 performed significantly higher compared to the non-SBA group with a mean of 39.29, thus, there is significant difference found in their performance. It must be noted that prior to the intervention, the SBA group also performed significantly higher than the non-SBA group.

Table 18. Comparison of students' performance on the posttest.

GROUP	N	MEAN	SD
SBA	25	43.36	6.17
Non-SBA	28	39.29	5.46
TOTAL	53	41.21	6.10

Source	SS	Df	MS	F-value	Sig.
Group	2987.836	1	2987.836	153.696	.000*
(Pre-test) Covariate	745.478	1	745.478	38.348	.000
Error	971.996	50	19.440		
Total	91934.000	53			

Note: * – significant at 0.05 level

Freeman, et al. (2014) found out that the students in classes with traditional lecturing were 1.5 times more likely to fail than students in classes with active learning. With this,

appropriate secondary school knowledge backed by any interventions in mathematics should be given more emphasis so as to make students competent for future career as mentioned by Baruah (2011).

Pierce (2017) added that this approach looks very different from one classroom to the next. But when this blended learning is done well, it typically involves some form of student choice in their own learning.

Analysis of Covariance (ANCOVA) of Retention Test Results Between Interventions

Table 19 presents the analysis of covariance (ANCOVA) of retention test results between interventions. We can observe that the F-value between groups is equal to 154.729 with probability value of 0.000* which indicates a highly significant difference, thus the null hypothesis that there is significant difference on students’ performance in terms of retention test to be rejected. This finding implies that students exposed to SBA environment with a mean of 42.40 performed statistically not equal to the students exposed to non-SBA environment with a mean of 37.75. Moreover, based on the values of the mean on the posttest and retention test, there is an increase in their retention test mean score in both groups as reflected in Table 1.

According to Limaye, Ahmed, Ohkubo and Ballard (2018), there is higher retention among students exposed to blended learning compared to those who were exposed to non-blended learning.

Table 19. Comparison of students’ performance on the retention test.

GROUP	N	MEAN	SD
SBA	25	42.40	5.58
Non-SBA	28	37.75	5.40
TOTAL	53	39.94	5.91

Source	SS	Df	MS	F-value	Sig.
Group	3563.006	1	3563.006	154.729	.000*
(Pre-test) Covariate	381.859	1	381.859	16.583	.000
Error	1151.391	50	23.028		
Total	86379.000	53			

Note: * – significant at 0.05 level

Differences on the perceived 21st Century Skills of Students Towards Mathematics when exposed to SBA and Non-SBA

As shown in Table 20, the perceived 21st century skills of students when exposed to the SBA environment had a mean score of 4.21 with standard deviation of 0.53 while students exposed to non-SBA environment had a mean score of 4.03 and standard deviation of 0.79.

Table 20. Comparison of the perceived 21st century skills of students between groups

GROUP	N	MEAN	SD
SBA	25	4.21	.53
Non-SBA	28	4.03	.79
TOTAL	53	4.11	.63

Source	SS	Df	MS	F-value	Sig.
Group	16.751	1	16.751	42.300	.000*
(Pre-test) Covariate	.124	1	.124	.314	.578
Error	19.800	50	.396	.996	.323
Total	918.611	53			

Note: * – significant at 0.05 level

Moreover, the table shows an F-value of 42.300 and a probability of 0.000* indicating significant difference in the perceived 21st century skills of two groups. Thus the null hypothesis stating that the perceived 21st century skills of the VBCA students exposed to SBA is non-comparable to those who are exposed to non-SBA is rejected.

According to Cantones (2014), 21st century skills involve critical thinking and problem solving, communication and collaboration and others. These skills are the keys to unlock a lifetime of learning and creative work. As it turns out, using intervention as the source of new knowledge that is being learned--- applying skills like critical thinking, problem solving, and creativity to the content knowledge--- increases motivation and improves learning outcomes rather than purely traditional instruction.

In addition, taking some portion of their classes online helps students hone their digital literacy skills, communication skills, ethics and integrity, motivation and work ethics, persistence and resilience, leadership and teamwork, and critical thinking and problem solving which is important for teenagers who will soon be entering the 21st century workforce.

DISCUSSION

The study was conducted to determine the difference of perceived 21st century skills of students and mathematics performance of students in Grade 9 Mathematics at Valencia Baptist Christian Academy. Two sections were chosen based on the quasi-experimental research design wherein the experimental group and the control group were selected according to the availability of their internet connection in their houses. There were 25 selected students in the experimental group and 28 students in the control group as the respondents of the study have been utilized.

Specifically, it answered the questions on the level of perceived 21st century skills of students as exposed to SBA and those exposed to non-SBA before and after intervention, level of performance of students when exposed to SBA and those exposed to non-SBA, difference in performance of students in mathematics when exposed to SBA and those exposed to non-SBA, and difference on perceived 21st century skills of students when exposed to SBA and those exposed to non-SBA.

The SBA group has a mean score of 21.52 in the pretest which indicates that students' scores are deficient indicating a very low performance. The non-SBA group has a mean score of 22.21 which also indicates that students' scores don't meet the expectation indicating a very low performance in the pretest. On the posttest and retention test the SBA group obtained a mean score of 43.36 and 42.40 respectively indicating a "moderate performance" result, while the non-SBA group had a mean score of 39.29 and 37.75 indicating also a "moderate performance".

On the 21st Century Skills of the students, the overall mean score before the intervention is 3.37 and 3.23 in the SBA and non-SBA group, respectively. This shows that students have high perception in 21st Century Skills towards Mathematics as a subject. After the intervention, the overall mean score of students is 4.20 and 4.03 in the SBA and non-SBA group, respectively. This implies that both groups have high perception in 21st century skills towards Mathematics after the intervention.

The F-value between groups is 153.696 with a probability of 0.000 ($p < 0.05$) indicating that there is a significant difference, thus the null hypothesis that the students' performance when exposed to SBA is non-comparable with those who are exposed to non-SBA in terms of posttest is rejected. The F-value between groups is 154.729 with probability value of 0.000 ($p < 0.05$) which indicates that there is significant difference, thus the null hypothesis that students' performance when exposed to SBA is not statistically equal to those who are exposed to non-SBA in terms of retention is to be rejected.

The students' perception in 21st century skills when exposed to SBA had a mean score of 4.21 with a standard deviation of 0.53, while students exposed to non-SBA had a mean score of 4.03 with a standard deviation of 0.79. The results show an F-value of 42.300 with a probability of 0.000 indicating that there is a significant difference in the perceived 21st century skills of the two groups, thus the null hypothesis stating that the perceived 21st century skills of the students exposed to SBA is non-comparable to those who are exposed to non-SBA is to be rejected.

CONCLUSION:

Based on the findings of the study, the following conclusions are drawn:

The students' performance, exposed to SBA and non-SBA showed that the students have low performance in their pretest, and moderate performance in both posttest and retention test. There is an increase in the level of performance of students from very low to moderate performance in both groups.

Students in both SBA and non-SBA groups have high perceived 21st century skills towards Mathematics as a subject before the intervention. After the treatment, both groups remain to have a high perceived 21st century skills towards the subject.

The performance of the students when exposed to the SBA and those exposed to the non-SBA in terms of posttest and retention test is not statistically equivalent. It implies that students exposed to SBA have higher performance of students than the students exposed to non-SBA in terms of post-test and retention test.

There is significant difference in the perceived 21st century skills of the students who were exposed to the SBA and that of students exposed to the non-SBA. It implies that perceived 21st century skills of SBA is higher than non-SBA in terms of critical thinking and problem solving, motivation and work ethics, ethics and integrity, persistence and resilience, leadership and teamwork, and communication skills.

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