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Selecting an SPA (special program in the arts) major for high school students using AHP combined with interest inventory

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Abstract

The Special Program in the Arts (SPA) is a program by the Department of Education (DepEd) for high school students with potential or talents in the arts, namely, music, visual arts, theater arts, media arts, creative writing and dance. Students enrolled in SPA-identified schools are required to take specialised 2-hour classes daily on their specific majors beginning on their first year as part of their curriculum. The Magallanes National High School (MNHS) in Agusan del Norte is one of the DepEd schools offering in the Philippines. Unfortunately, it is observed that every year, some students are changing SPA majors on their second or third year which causes a problem to the school in arranging their back subjects. Some of the common reasons for shifting include late realisation of interest, career opportunity and expenses. In this study, an interest inventory is conducted among SPA students of MNHS to determine their major inclination. The analytical hierarchy process is then used to compare their different criteria for choosing SPA majors such as late realisation of interest, career opportunity and financial consideration. The results of the study show that most of the students shift to another specialisation due to the late realisation of their field of interest. Evaluation of the students using the proposed method shows that 77% of the students evaluated coincide with the major they are currently taking. Hence, the proposed method may be used to provide assistance to incoming first-year high school students in deciding what SPA major to take to avoid shifting of majors after their first year in high school.

Keywords: Arts, special program, SPA, Magallanes National High School.

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1. Introduction

Students nowadays acquire different potential or talents in the arts such as singing, dancing, acting, writing and drawing. Educators are obliged to develop the special talent they have for their future careers. As a consequence, the Department of Education (DepEd) has a nationwide program for these students. They call it the 'Special Program in the Arts (SPA)' which caters and develops the different potentials or talents of these students. In this program, the students have to choose their art of specialisation and develop for four years in high school as stated in DepEd Memorandum 339 series 2004.

The Magallanes National High School (MNHS) offers this SPA for almost 7 years. In fact, the school had already produced potential and talented graduates in this program since School Year 2014–2015. But we cannot deny the fact that there are students who have multiple talents or not sure of the majors they had chosen. As a consequence, some students have shifted from one specialisation to another in their second year or third year in high school.

From the school data, it is observed that the number of shiftees is increasing in every school year. The present school year has 10 shiftees which comprise 7% of the whole SPA students. This causes now a problem for the school in scheduling the back subjects of the students since the DepEd targets the 100% promotion to meet the EFA (Education for All) Goals.

Selecting majors for freshmen students in SPA is one of the many important choices students have in determining their future plans. This decision will impact them throughout their lives. Its essence will revolve around what the student wants to do with their life-term work.

Students in many cases will need the proper mentoring and guidance in making their choices to be able to succeed. It is important to help students to figure out the interest and passion which reflect in the process of selecting a major at school (Mappe & Wongthongtham, 2014). These proper mentoring and guidance will be initiated by the support system that comprises parents, relatives, siblings, peers, teachers and counselors (Borchert, 2002).

Analytical Hierarchy Process (AHP), since its development, has been a tool at the hands of decision-makers and researchers, and it is one of the most widely used multiple criteria decision-making tools (Saaty, 2008). Many outstanding works have been published based on the AHP: they include applications of AHP in different fields such as planning, selecting the best alternative, resource allocation, resolving conflict, optimisation and numerical extensions of AHP (Vargas, 1990; Zahedi, 1986).

AHP was also used for decision-making in engineering applications (Triantaphyllou and Mann, 1995). Some of these include its use in integrated manufacturing (Putrus, 1990), in the evaluation of technology investment decisions (Boucher & McStravic, 1991), in flexible manufacturing systems (Wabalickis, 1988), layout designs (Cambron & Evans, 1991) and also in other engineering problems (Wang & Raz, 1991). Bogdanoff (2009) also used AHP for supplier evaluation, whereas Al-Rafati (2008) used AHP in supplier selection for vendors of a photocopying machine. Even in Naval, AHP is used as a source selection methodology and its potential application within the Hellenic air force (Tsagdis, 2008).

This study aims to provide support to freshmen students in their decision making for choosing their specialisation using AHP combined with an interest inventory. Specifically, it aims to determine the criteria for deciding a major in SPA and apply AHP on the criteria obtained with the different majors as alternatives. This study will help the freshmen students in their decision making for choosing their specialisation during their first year in SPA in MNHS using the AHP to avoid shifting for the next years.

This paper is organised as follows. Section 1 gives a brief introduction of the study. The methodology is presented in Section 2. The results are presented and discussed in Section 3. A brief conclusion is given in Section 4.

2. Methodology

In this paper, the criteria to be used in AHP are obtained by conducting a survey to the students who had shifted to another major in SPA. In this survey, the students are given a checklist with different reasons for why they had shifted to another major. They are instructed to check as many as they can. And by consolidating the result, the top three reasons are the criteria for deciding major to be used in AHP.

The general approach of the AHP is to decompose the problem and to make pairwise comparisons of all elements (attributes, alternatives, etc.) on a given level with respect to the related elements in the level just above. The degree of preference or intensity of the decision-maker in the choice for each pairwise comparison is quantified on a scale of 1–9, and these quantities are placed in a matrix of comparisons. The suggested numbers to express degrees of preference between the two elements ai and a are shown in Table 1.

Table 1. Trans-quantitative scores

a_{ij}	1	2	3	4	5	6	7	8	9
the importance of a_i:a_j	Fair		weakly strong		strong		obviously strong		absolutely strong

Even numbers (2, 4, 6 and 8) can be used to represent compromises among the preferences above.

A matrix A of comparisons for all elements is the next constructed with preference numbers obtained as above.

$$A_{nxn} = \begin{bmatrix} \cdots & \cdots \\ \vdots & \ddots & \vdots \\ \cdots & \cdots \end{bmatrix}$$

where

n = the total number of the attributes in the level,

a_{ij} = a_i / a_j,

i = index for the rows of the matrix and

j = index for the columns of the matrix.

For inverse comparisons such as a_j and a_i, the reciprocal of the preference number for a_i to a_j (above) is used.

In every criterion, the alternatives, which are the different majors, are rank through a survey to SPA students. In this survey, the students rank the alternatives depending on the criteria they are referring to. The results are tabulated to obtain the average ranks. Another survey is given to the experts/teachers of the different majors to rank the criteria according to its importance in a certain student who wishes to enroll in SPA. They can have the same rank with two or more criteria if they think they are of equal importance. The average rank in every criterion is also computed.

The average ranks of the alternatives in every criterion and the average ranks of the criterion itself are utilise to make the pairwise comparisons. Rank 1 means it is weakly strong than rank 2, strong than rank 3, obviously strong than rank 4 and absolutely strong than rank 5. The other ranks are represented in Table 2.

Table 2. Degree of preference for different ranks

Ranks	1	2	3	4	5
1	Fair	Weakly strong	strong	Obviously strong	Absolutely strong
2		fair	Weakly strong	strong	Obviously strong
3			fair	Weakly strong	Strong
4				fair	Weakly strong
5					Fair

The blank spaces mean the inverse comparisons of each rank. In case the student has no equal ranks and reaches to rank 6, the researcher can use the 'even numbers' to adjust their preferences.

By referring to Table 2, the pairwise comparisons of the alternatives in every criterion and the pairwise comparison of the criteria can be obtained.

In AHP, pairwise comparisons must be consistent; otherwise, it is not reliable. Each of the pairwise comparisons obtained is being computed for its consistency before proceeding to the next step.

The next step is to prioritise the decision alternatives within each criterion which is referred to as synthesisation. The approximation method for synthesisation provides a reasonably good estimate of preference scores for each decision in each criterion which are as follows: (1) develop a preference scores by adding the values in each column of the pairwise comparison matrices; (2) divide each value in a column by its corresponding column sum which results into normalised matrices; (3) obtain the average of the values in each row (these are preference vectors); (4) combine the vectors of preferences for each criterion (from step 3) into one preference matrix that shows the preference for each criterion; (5) compute the vectors of preference also for the pairwise comparisons of the criteria by following steps 1 & 2 and (6) multiply the preference matrix to the preference vector of the criteria to obtain the final score of each alternative.

Based on the result of synthesisation, the alternatives are rank by their final score. The alternative with the highest score is the most preferred alternative. Accordingly, the alternative with the highest score is the most suitable major for a certain student in SPA of MNHS who responded to the survey.

In order to make the process of AHP conducive to determine the final ranks of the SPA majors in every student, a simple Microsoft Excel Program is created. Through this program, the user will just input the ranks of the different majors on the result of the student's Interest Inventory and it will automatically give the final rank of the majors based on the AHP.

The process is applied to 15 students who had shifted to another major and 15 non-shiftee students. Their results on AHP are compared to the major where they transferred or they enrolled if it coincides. To validate the result, the fitness percentage is computed. To do this, we have the formula

α = (no. of students who fits in their majors)/30

where 30 is the number of sample students who wants to be validated.

And Cronbach's Alpha interval validity rule of thumb is used if it passes the validity which is shown in Table 3.

Table 3. Cronbach's alpha interval of validity

Cronbach's alpha interval	Validity
$\alpha \geq 0.9$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable
$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

3. Results and discussion

Twenty shiftee students were surveyed to determine their reasons for shifting to another major in SPA. The survey/checklist contains the students' different possible reasons where they are instructed to check as many as they can. Based on the results of the survey, it was found out that 70% of them agreed that the reason of their shifting is the late realisation of interest, 50% said that it is because of financial matters, 45% of them agreed that it is because of career opportunity, 20% is because of influenced of friends or other people and also 20% are because of exploration. Therefore, the top three reasons, which are (1) interest in subject, (2) financial matters and (3) career opportunity, are the criteria in selecting an SPA major which will undergo the process of Analytic Hierarchy Process.

In the 'interest in subject' criterion, 30 SPA major students, of which 15 are shiftees and the other 15 are non-shiftees, were required to answer an 'Interest Inventory'. An 'Interest Inventory' is a 30-item multiple-choice test in which each of the choices corresponds to a certain major where a student was fit into. The major with the highest score is considered as the first rank of the alternatives, the second-highest on rank 2, third-highest on rank 3 and so on. If there are majors who have the same scores, their ranks would be the same also. The results of the ranks of the alternatives in each student surveyed are shown in Table 4.

Table 4. Ranks of the majors in interest inventory

No.	Music	Dance	Theater arts	Media arts	Visual arts	Creative writing
1	4	3	1	2	5	4
2	4	3	2	5	1	4
3	1	2	3	5	2	4
4	3	1	4	2	5	5
5	3	5	1	6	4	2
6	4	2	3	5	1	3
7	2	6	1	5	4	3
8	5	1	2	3	4	2
9	4	5	3	6	2	1
10	2	2	2	4	1	3
11	1	4	2	5	3	2
12	3	1	5	4	2	4
13	3	4	2	5	1	2
14	3	5	6	4	2	1
15	4	1	3	2	3	3
16	3	2	4	4	1	5
17	3	1	4	4	2	3
18	1	2	2	5	4	3
19	1	3	2	2	2	2
20	4	1	2	6	3	5
21	3	1	2	2	1	3
22	1	3	2	4	2	2
23	3	1	1	5	4	2
24	5	1	4	5	2	3
25	4	2	1	5	3	3
26	4	3	3	4	2	1
27	5	3	2	1	4	3
28	1	2	1	2	4	3
29	1	3	4	6	5	2
30	3	2	2	4	3	1

Table 2 was then used to determine the pairwise comparisons of every student in the Interest Inventory. The sample results of the pairwise comparisons of the first two students who responded to the interest inventory areshown in Tables 5 and 6.

Table 5. Pairwise comparisons of the alternatives for student 1

Majors	Music	Dance	Theater arts	Visual arts	Media arts	Creative writing
Music	1	1/3	1/7	1/5	3	1
Dance	3	1	1/5	1/3	5	3
Theater arts	7	5	1	3	8	7
Visual arts	5	3	1/3	1	7	5
Media arts	1/3	1/5	1/8	1/7	1	1/3
Creative Writing	1	1/3	1/7	1/5	3	1

Table 6. Pairwise comparisons of the alternatives for student 2

Majors	Music	Dance	Theater arts	Visual arts	Media arts	Creative writing
Music	1	1/3	1/5	3	1/7	1
Dance	3	1	1/3	5	1/5	3
Theater arts	5	3	1	7	1/3	5
Visual arts	1/3	1/5	1/7	1	1/8	1/3
Media arts	7	5	3	8	1	7
Creative Writing	1	1/3	1/5	3	1/7	1

Another 30 random SPA students were surveyed to determine which of the different majors was least expensive for the second criterion. In this survey, the respondents were asked to rank the majors from 1 to 6 starting from the least expensive one. The same rank can be given to two or more majors if they thought they were equal in terms of expenses. The average ranks of the different majors are shown in Table 7.

Table 7. Ranks of the alternatives in financial matters

Ranks	Alternatives
1	Media arts
2	Creative writing
3	Visual arts
4	Music
5	Dance
5	Theater arts

Using the result of the ranks in financial matters and Table 2, the pairwise comparisons of the alternatives are shown in Table 8.

Table 8. Pairwise comparisons of the alternatives in financial matters

Majors	Music	Dance	Theater arts	Visual arts	Media arts	Creative writing
Music	1	3	3	1/3	1/7	1/5
Dance	1/3	1	1	1/5	1/9	1/7
Theater Arts	1/3	1	1	1/5	1/9	1/7
Visual Arts	3	5	5	1	1/5	1/3
Media Arts	7	9	9	5	1	3
Creative Writing	5	7	7	3	1/3	1

The same 30 random SPA students were surveyed to determine the average ranks of the different majors based on their significance on career opportunity for the third criterion. In this survey, the students were asked to rank the majors starting rank 1 as they think is the most significant on their future career, rank 2 as the second significant on their future career and so on. The same rank for two or

more majors is allowed if they thought they have the same significance on their future careers. The average ranks are shown in Table 9

Table 9. Ranks of alternatives in career opportunity

Ranks	Majors
1	Media arts
2	Visual arts
3	Creative writing
4	Dance
5	Music
6	Theater arts

From this result, Table 2 was used again to determine the pairwise comparisons of the majors which are resulted in Table 10.

Table 10. Pairwise comparisons of alternatives on career opportunity

Majors	Music	Dance	Theater arts	Visual arts	Media arts	Creative writing
Music	1	1/3	3	1/7	1/8	1/5
Dance	3	1	5	1/5	1/7	1/3
Theater arts	1/3	1/5	1	1/8	1/9	1/7
Visual arts	7	5	8	1	1/3	3
Media arts	8	7	9	3	1	5
Creative writing	5	3	7	1/3	1/5	1

To determine the pairwise comparisons of the criteria, 15 experts/teachers were surveyed to determine the average ranks of the criteria. In this survey, the respondents were asked to rank the criteria according to which they thought would be the most significant in a certain student in choosing their majors on rank 1, the next significant on rank 2 and the least significant on rank 3. The same rank on two or three majors is allowed if they thought they are equal in choosing their majors. The average rank of each criterion was obtained. It shows that the most significant criterion in choosing a major in SPA is the interest on subject, followed by the career opportunity, and then the financial matters. Using these ranks and Table 2, the pairwise comparisons of the criteria are shown in Table 11.

Table 11. Pairwise comparisons of the criteria

Criteria	Interest in major	Career opportunity	Financial matters
Interest in major	1	3	5
Career opportunity	1/3	1	3
Financial matters	1/5	1/3	1

The pairwise comparisons of the alternatives and criteria must be consistent. The pairwise comparisons on AHP are consistent if after the computation of the consistency ratio, $CR = CI/RI < 0.1$, otherwise, it fails which means it is not powerful enough. The following were the result of the computations of the consistency ratio of the different pairwise comparisons: for the Interest Inventory of Student 1, CR = 0.0459; for the Interest Inventory of Student 2, CR = 0.0459; for the Financial Matters, CR = 0.0455; for the Career Opportunity, CR = 0.0801 and for the Criteria, CR = 0.0334. Since all the computed CR < 0.1, then all the pairwise comparisons were consistent.

Using the synthesisation method in AHP, the final scores of Student 1 and Student 2 are shown in Tables 12 and 13, respectively.

Table 12. AHP computation on student 1

Majors	Final score	Rank
Music	0.0634817	6
Dance	0.1023894	5
Theater arts	0.3009377	1
Visual arts	0.2236426	2
Media arts	0.1880645	3
Creative writing	0.1214842	4

Table 13. AHP computation on student 2

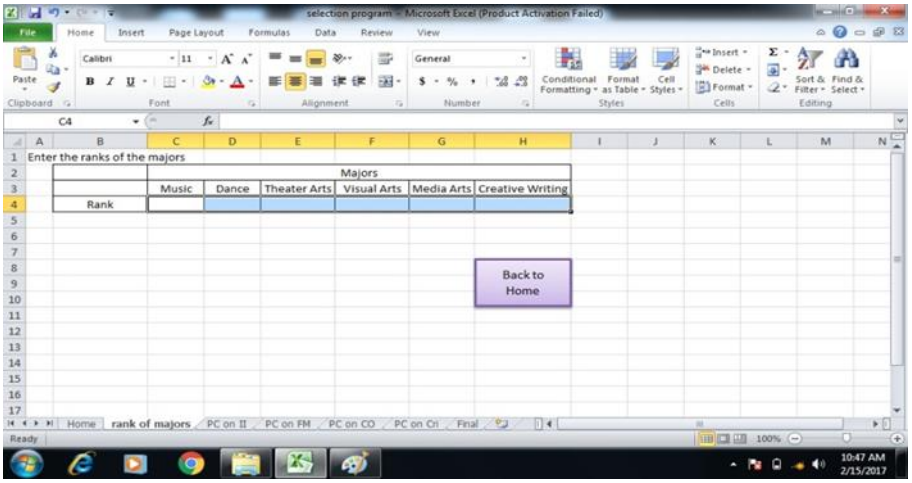
Majors	Final score	Rank
Music	0.0634817	6
Dance	0.1023894	4
Theater arts	0.1717782	2
Visual arts	0.083524	5
Media arts	0.4573426	1
Creative writing	0.1214842	3

Based on this result, Student 1 is most fitted to Theater Arts, then to Visual Arts, Media Arts, Creative Writing, Dance and Music. This result is fitted to the present major of Student 1 which is Theater Arts. Student 2 is most fitted to Media Arts then to Theater Arts, Creative Writing, Dance, Visual Arts and Music. This result of AHP of Student 2 is not fitted to the present major of Student 2 which is Dance.

In the implementation of the study, an excel program was prepared to compute its pairwise comparisons, its consistency and the final score of the AHP. In this program, the user will just input the ranks of the majors/alternatives based on the student's Interest Inventory and it will do the synthesisation and give the final ranks of the majors.

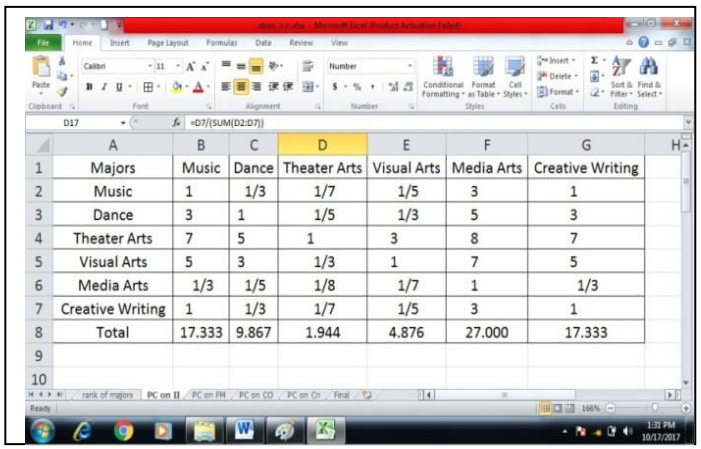
Some of the screenshots of the program are shown below:

A. Screenshot of where the user enters the rank of the majors in Interest Inventory

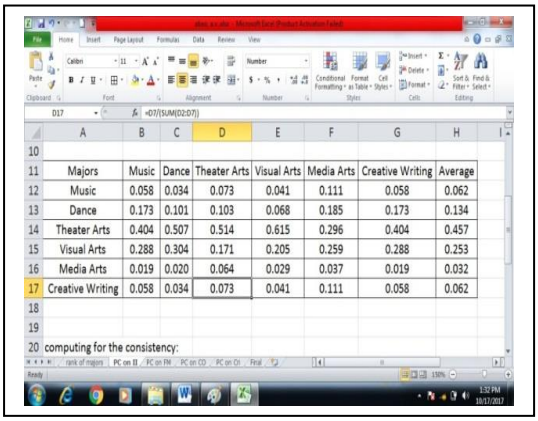


After encoding the rank of the majors, the program automatically gives its pairwise comparison and computes its consistency on the next sheet.

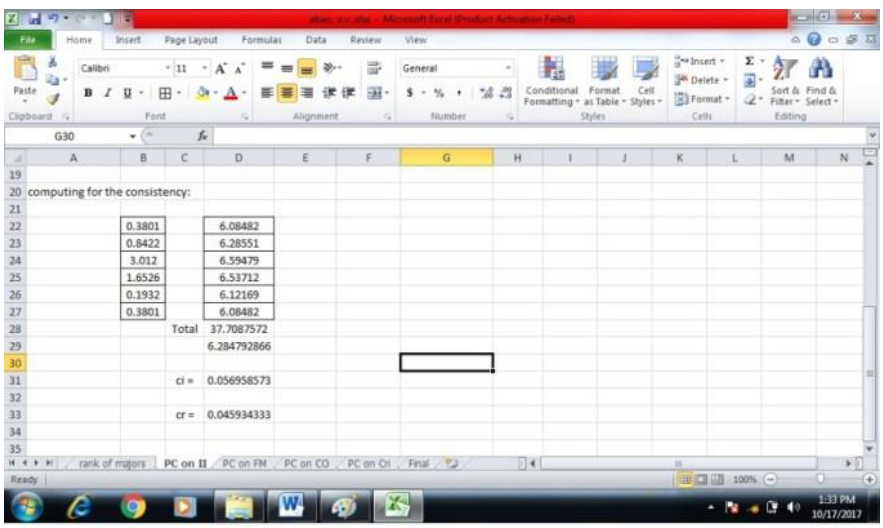
B. Screenshots of the pairwise comparisons and computation of consistency on Student 1 is shown below.



	A	B	C	D	E	F	G
1	Majors	Music	Dance	Theater Arts	Visual Arts	Media Arts	Creative Writing
2	Music	1	1/3	1/7	1/5	3	1
3	Dance	3	1	1/5	1/3	5	3
4	Theater Arts	7	5	1	3	8	7
5	Visual Arts	5	3	1/3	1	7	5
6	Media Arts	1/3	1/5	1/8	1/7	1	1/3
7	Creative Writing	1	1/3	1/7	1/5	3	1
8	Total	17.333	9.867	1.944	4.876	27.000	17.333

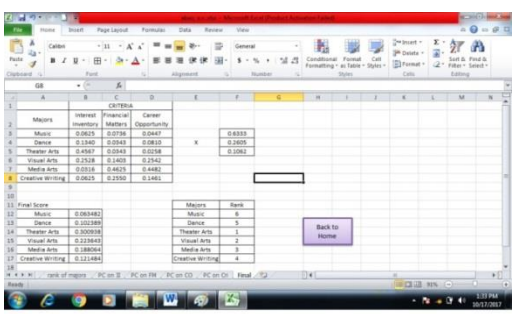


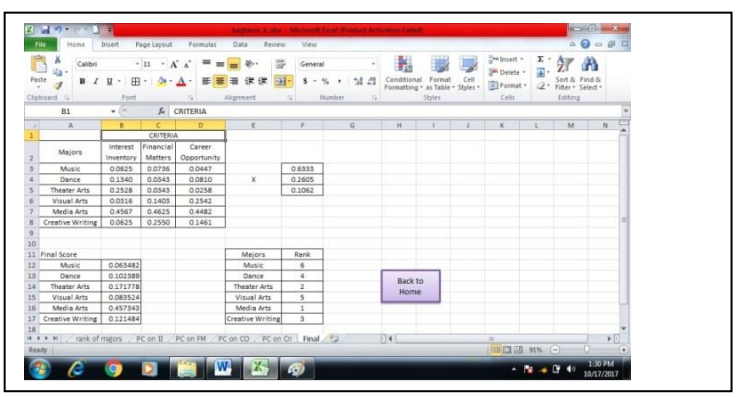
	A	B	C	D	E	F	G	H
11	Majors	Music	Dance	Theater Arts	Visual Arts	Media Arts	Creative Writing	Average
12	Music	0.058	0.034	0.073	0.041	0.111	0.058	0.062
13	Dance	0.173	0.101	0.103	0.068	0.185	0.173	0.134
14	Theater Arts	0.404	0.507	0.514	0.615	0.296	0.404	0.457
15	Visual Arts	0.288	0.304	0.171	0.205	0.259	0.288	0.253
16	Media Arts	0.019	0.020	0.064	0.029	0.037	0.019	0.032
17	Creative Writing	0.058	0.034	0.073	0.041	0.111	0.058	0.062
20	computing for the consistency:							



	A	B	C	D
20	computing for the consistency:			
22		0.3801		6.08482
23		0.8422		6.28551
24		3.012		6.59479
25		1.6526		6.53712
26		0.1932		6.12169
27		0.3801		6.08482
28			Total	37.7087572
29				6.284792866
31			ci =	0.056958573
33			cr =	0.045934333

C. Screenshots of the computation of the final score of each major of Students 1 & 2.





The process was conducted to 15 shiftee and 15 non-shiftee students to tests its validity. The rank 1 major that was resulted in the AHP will compare to their present major. The result is shown in Table 14.

Table 14. Comparison of majors

No.	Present major	Result of AHP	Remarks
1	Media arts	Media arts	Fitted
2	Dance	Visual arts	Not fitted
3	Music	Music	Fitted
4	Media arts	Media arts	Fitted
5	Theater arts	Theater arts	Fitted
6	Visual arts	Visual arts	Fitted
7	Music	Theater arts	Not fitted
8	Dance	Dance	Fitted
9	Creative writing	Creative writing	Fitted
10	Dance	Visual arts	Not fitted
11	Music	Music	Fitted
12	Dance	Dance	Fitted
13	Media arts	Visual arts	Not fitted
14	Creative writing	Creative writing	Fitted
15	Media arts	Media arts	Fitted
16	Visual arts	Visual arts	Fitted
17	Dance	Dance	Fitted
18	Music	Music	Fitted
19	Music	Music	Fitted
20	Dance	Dance	Fitted
21	Dance	Visual arts	Not fitted
22	Music	Music	Fitted
23	Theater arts	Theater arts	Fitted
24	Creative writing	Dance	Not fitted
25	Theater arts	Theater arts	Fitted
26	Creative writing	Creative writing	Fitted
27	Media arts	Media arts	Fitted
28	Dance	Music	Not fitted
29	Music	Music	Fitted
30	Creative writing	Creative writing	Fitted

Computing Cronbach's alpha of validity by using the formula, α = 23/30 = 0.77. Referring to Table 3 of Cronbach's alpha of validity with α = 0.77, it is 'acceptable'. Therefore, the process is valid.

4. Conclusion and recommendation

The shifting of SPA majors of students in their second or third year in Junior High School has always been a problem of MNHS. This paper conducted the AHP to address the problem. From the survey conducted, the reasons for their shifting were Late Realisation of Interest in Subject, Financial Matters, and Career Opportunity which were used as the criteria for AHP. An Interest Inventory was conducted for the first criterion to determine the pairwise comparisons of the majors of SPA which are the alternatives of AHP. Other surveys were conducted to determine the pairwise comparisons of the alternatives of the second and third criterion and the pairwise comparison of the criteria itself.

From the computations of AHP in every respondent, it was found that if Media Arts was rank as 1 or 2 in a student's Interest Inventory, it was very likely that it would be the highest on the final score of AHP since Media Arts ranked as 1 in the two criteria, namely: financial matters and career opportunity.

The result of AHP will be recommended to the student in selecting his/her major in SPA but it is still the decision of the student to choose the major he/she likes to enroll. However, the result of the AHP will be utilised to better assist the students in selecting their majors in SPA.

Furthermore, it is recommended that on opening classes, this study will be applied to the incoming grade 7 students who wish to enroll in SPA of MNHS so that the shifting of majors on the coming years will be lessen if not eliminated.

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