Analytic Hierarchy Process Based Internship Selection

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Abstract. The summer internship is an important way for high school students to increase their social experience. However, it is difficult for high school students to choose a suitable internship due to their lack of social experience and lack of self-awareness. At the same time, the personality of each high school student is very different, and the requirements of different internships are also very different. In order to recommend suitable jobs for high school students, it established a recommendation model based on the analytic hierarchy process (AHP). Results show that the model has a very good effect.

1. Introduction
High school students have become more independent and independent, high school students have gradually stepped into society to adapt to social life and work. Working in the spare time of summer vacation has become the daily life of some high school students. In addition to improving the personal abilities of high school students, high school students can be paid for their summer jobs. The money earned can not only be used as pocket money to improve high school students' living standards, but also give high school students a sense of pride. Comparing working during school with working during summer vacation, working in summer vacation has more spare time than working in school. There are also more job opportunities and more jobs. This means it has more options to work in the summer. Some allow us to do virtual/electronic work from home, some require walking or cycling, and some require driving or taking the train. Each job offers a different number of hours per week, and hourly pay varies. Some involve physical activity or at least do not sit at a table (such as a cashier at a store, a lifeguard, or a waiter at a restaurant), while others are mostly sedentary and may use analytical and organizational skills (such as data analysis, office administration, or research). Faced with such a large number of summer jobs, how to choose a job most suitable for high school students is very important. In addition, while choosing a summer job for high school students, It is also important to engage in recreational activities to enrich their social contact and relax (such as exercise, outing, and social time with friends).

In the analysis of this complex problem, it used appropriate mathematical models to solve and judge summer internships suitable for high school students. The first part is divided into 10 factors that will affect high school students' choice of work. The second part is an example where subdivided 20 occupations, and through subjective judgments, the proportion of the 10 influencing factors in the first step to the selection of these 20 occupations was stored, divided by 10, and the score representation illustrates these Factors affecting career choices. Then through the analytic hierarchy model to complete analysis of the scores of these influencing factors. The third part is some examples of characters after the formula is generated. How these examples are in our lives and use our formula to calculate that these high school students are more suitable for a certain profession. Through these 20
examples, it can perceive the essence of modeling for a practical problem, and then in the fourth part, it designed a website to understand people's information in the form of a questionnaire. The purpose of this website is to find suitable job types and ideal jobs when the resume applicants start to apply for a job, which is conducive to high school students' choice to complete the job in a limited number of consecutive times.

So in this paper, it will build a model to evaluate how high school students choose summer jobs and help them find the "best" job.

2. Methodology
In the Methods section, the first factor is to consider when choosing an internship, and then show how to use the Analytic Hierarchy Process (AHP) to take these factors into account to apply for different internships for different people. In the AHP, it has simplified the model to a certain extent in order to express it more clearly. Through the actual investigation, it chose the following ten factors to consider.
1. Time (working hours & time period - morning and evening shifts, etc.). 2. Type of work (physical or mental). 3. Money earned (control variable). 4. Meaning at Work (two-way choice). 5. Distance from home. 6. Level of infrastructure development. 7. Risk factor. 8. How tired you are at work 9. Whether it's something you enjoy doing. 10. The difficulty of applying for part-time jobs

2.1 Analytic hierarchy process
Analytic hierarchy process (AHP) is a decision-making problem according to the general objective, the Straton goal, evaluation criteria, and the order of the specifications for the voting scheme are decomposed into different hierarchies, and then, by solving the judgment matrix eigenvector calculated for each element of each level on a hierarchy of an element of priority weights, finally, the method of weighted sum hierarchical merging each alternative solution on the final total target weight, the final weight so much as the optimal solution.

1) Establish a hierarchical structure model: According to their mutual relations, the decision objectives, factors (decision criteria), and decision objects are divided into the highest, middle, and lowest levels, and the hierarchy chart is drawn. Target level: B1 Best summer job. Criterion level: the influencing factors of the scheme include: C1 working period, C2 mental work, C3 salary, C4 risk coefficient, C5 fatigue, and C6 physical work. Solution layer: created 21 professional solutions respectively: A1, A2 librarian coffee (tea) technicians, technicians, A5, A4, A3 museum announcer programming Courier, A6 hair handbill, A7 restaurant waiters, A8 grocery stories salesman, A9 A10 translation, accounting, A11 the lifeguard, A12 models, A13 from media, A14 cleaners, A15 tutor, A16 guide, A17 freelance writer, A18 WeChat business, A19 etiquette, A20 photographer.

2) When determining the weight between factors at all levels, if it is just a qualitative result (the scenery accounts for 80%, the cost is 10%, etc.), it is often not easy to be accepted by others. Therefore, Santy et al. put forward the consistent matrix method, namely: Instead of comparing all the factors together, compare them in pairs; The relative scale is adopted to minimize the difficulty of comparing factors with different natures so as to improve the accuracy. A pairwise comparison matrix is a ratio that indicates the relative importance of all factors at one level to a factor at the next level (quasi side or target).
The elements $\mathbf{R}$ of the pairwise comparison matrix represent the result of the comparison of the first factor with respect to the second factor $\mathbf{J}$, which is given using Santy's 1-9 scale method.

| The factor I over factor J | Quantitative values |
|-----------------------------|---------------------|
| As important                | 1                   |
| A little important          | 3                   |
| More important              | 5                   |
| Highly important            | 7                   |
| Extremely important         | 9                   |
| The median of two adjacent judgments | 2,4,6,8             |

3) Single ranking: The element of $\mathbf{W}$ is the ranking weight value of the relative importance of a factor at the same level for the factor at the previous level. This process is called single ranking. Whether the single ranking can be confirmed or not requires a consistency test, which refers to determining the allowable range of inconsistency for the paired comparison matrix.

| G | C1  | C2  | C3  | C4  | C5  | C6  | C7  | C8  | C9  | C10 |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| C1 | 1   | 1/2 | 1/3 | 5   | 2   | 1/3 | 2   | 4   | 7   |     |
| C2 | 1   | 4   | 3   | 7   | 2   | 3   | 6   |     |     |     |
| C3 | 1   | 5   | 2   | 2   | 5   | 2   | 4   |     |     |     |
| C4 | 1   | 3   | 2   | 4   | 2   | 4   | 1/4 |     |     |     |
| C5 | 1   | 1/3 | 7   | 1   | 1/3 | 3   |     |     |     |     |
| C6 | 1   | 1/3 | 1/3 | 1   | 3   |     |     |     |     |     |
| C7 | 1   | 5   | 1/4 | 2   |     |     |     |     |     |     |
| C8 | 1   | 5   | 1/3 |     |     |     |     |     |     |     |
| C9 | 1   | 3   |     |     |     |     |     |     |     |     |
| C10|     |     |     |     |     |     |     |     |     | 1   |

4) Construct judgment (paired comparison) matrix: When determining the weight of each level between various factors, if it is the result of the qualitative, is often not easy to be accepted, thus Saaty consistent matrix method is put forward, that is not all factors are put together to compare, but two compare, at this time on a relative scale to minimize properties of different factors to compare the difficulty, in order to improve the accuracy. For example, for a criterion, the alternatives under it are compared in pairs and rated according to their importance.

5) Hierarchical single sort and its consistency check: The eigenvector corresponding to the maximum eigenvalue of the judgment matrix is denoted as $\mathbf{W}$ after normalization. The element of $\mathbf{W}$ is the ranking weight value of the relative importance of a factor of the same level to a factor of the previous level. This process is called hierarchical single ranking. If the single order of hierarchy can be confirmed, a consistency test is needed. The so-called consistency test refers to the determination of the allowable range of inconsistency for $\mathbf{A}$. Where, the unique nonzero characteristic root of n-order uniform matrix is N; The largest characteristic root of n-th order positive reciprocal matrix $\mathbf{A}$, if and only if, $\mathbf{A}$ is $\mathbf{A}$ consistent matrix. Since lambda is continuous depending on lambda, the more lambda is larger than N, the more $\mathbf{A}$ is inconsistent. The consistency index is calculated using CI, and the smaller the CI, the greater the consistency. Using the eigenvector corresponding to the maximum eigenvalue as the weight vector of the influence degree of the factor being compared on the upper layer, the greater the degree of inconsistency, the greater the judgment error caused. Thus, the inconsistency of $\mathbf{A}$ can be measured by the size of the -n value.

The consistency index is defined as:
CI = \frac{\lambda - n}{n - 1}

Cl=0, complete consistency; CI is close to 0, with satisfactory consistency; The larger the CI, the greater the inconsistency. To measure the size of CI, the random consistency index RI is introduced:

RI = \frac{CI_1 + CI_2 + \cdots + CI_n}{n}

Where the random consistency index RI is related to the order of the judgment matrix. In general, the greater the order of the matrix, the greater the probability of random consistency deviation. Considering that the deviation of consistency may be caused by random reasons, when testing whether the judgment matrix has satisfactory consistency, CI and random consistency index RI should be compared, and the test coefficient CR can be obtained, with the formula as follows:

CR = \frac{CI}{RI}

6) Overall ranking and consistency check: Calculating the weight of the relative importance of all factors at a certain level to the highest level (the total goal) is called the total hierarchy ranking. This process goes from the top to the bottom.

2.2 Project model

The above results and data were fed into the model, where got a measure of importance by asking people who were looking for jobs. In fact, this level of importance varies from person to person, so the algorithm of rating each person based on their characteristics is very appropriate.

It can be seen from the above results that, for the examples used in the method, people pay more attention to salary and return, but they do not care much about the degree of fatigue. Therefore, when choosing a job, you can pay more attention to those positions that enhance your ability but are more tired.

3. Results

It used the model in the Methods section and then selected 10 typical high school students with different personalities. Then the 10 high school students were recommended jobs that fit their personalities. For these 10 high school personality acquisition, it is also used to ask them to experience the different characteristics of the internship career.

Person 1: Frank is a senior three student about to graduate. He is looking for an internship. He is a good student and often helps other students in his class to solve their study problems. His expected salary for his job is not very high, but he doesn't want to do manual work very much. Frank doesn't think about the distance to his workplace, because he has graduated and doesn't have much to do. Meanwhile, his parents can pick him up and take him to his workplace.

From the above character setting, it can be seen that Frank is a good student. At the same time, he has the experience of explaining exercises in his school life, which enables him to clearly explain the problems that he cannot solve for his classmates. Therefore, his social ability must be greater than 5., And because he is a recent graduate, he has relatively more time. The parents of the character mentioned above can drop the student off at any time at his workplace, thus solving the problem of
distance from home to workplace. His form of labor is basically based on mental work, and he does not have too many requirements for the work of fatigue, so it is very easy for him to arrange the work.

From Frank's analysis above, it can be seen that Frank is very suitable for the job of a tutor. Because after the above analysis of this person's requirements, he is very suitable for the job of a tutor. First of all, from his academic ability, it can find that He has a strong learning ability and has the ability to teach other students to master knowledge. His suitable teaching group should be middle school students and high school students, but the premise is to carry out teaching training. His social skills are relatively strong, and his experience teaching other students makes him a good teacher. Besides, he doesn't have to worry about the distance of his work.

Person 2: Luna is an international student who is about to go abroad, but because of the epidemic, he cannot go abroad to study during the summer vacation. She writes very well, both in English and Chinese. She also wrote novels and diaries and so on in her school days. Because she wants to work in the field of media in the future, she wants to do a similar job in this field. Luna is a student with strong social skills. She can naturally communicate with strangers (including foreigners). Her parents usually have a lot of things to do, so she has to go to work by herself and is more concerned about the distance to her workplace.

It can be seen from the above data that Luna is an overseas student who is going abroad soon, so she must have a good understanding of many policies and things that need to be prepared for studying abroad. Secondly, her writing style is very good. She often practices writing, so she must have good writing skills and the ability of mobile phone information. Because she pays much attention to writing, she must have good observation ability. At the same time, because she has a lot of contacts with people, she can write a lot of things. Because Luna was forced to stay in China due to the epidemic, she must have a long time to finish some literary writing. Based on the above data, it can be seen that Luna's work form is mental and physical strength. She does not have too much requirement on salary, but because it is for girls, the risk index must be higher. The degree of fatigue she can bear is around 5, and her social ability is more than 7. According to the above analysis of Luna, it can be found that the occupations of overseas study tutors, translators, and freelance writers are more suitable for Luna's job selection criteria.

Person 3: Daisy is a sophomore in high school. She wants to find a suitable job this summer vacation. She likes traveling very much and will travel with her family every holiday. She likes meeting strangers very much and is a very optimistic and outgoing girl. She is also good at learning. She likes history as a subject and likes to watch some documentaries in her daily life to enrich her knowledge. At the same time, she is also good at writing travel notes, because she goes to many places, so she will write down some very important things. She doesn't have a high standard for where she works because she can choose to travel to work.

From the above introduction to Daisy, it can be seen that she is a girl who likes traveling very much. She has a good understanding of travel strategies in many places and has her own unique views on scenic spots in some regions. At the same time, she has strong social skills, can fit into an organization well, and be very friendly to others. In terms of social skills, I think I can give her more than 7 points. At the same time, she often travels, so her physical strength should not be too bad. The occupation she chooses can include mental and physical work. Because it's in the summer, which is a good season for traveling, she will definitely allocate part of her summer vacation time to travel. At the same time, she doesn't have much requirement for her salary, so she prefers to accumulate experience and experience process in this job. Therefore, she is very suitable for such jobs as museum commentator and tour guide.

Person 4: Sunny is a senior high school graduate from an aristocratic school. Her family background is very good and she also receives this good education. She has a very good figure and is very good-looking. She learned many standard forms of etiquette at an exclusive school and knew a lot about VIP etiquette. At the same time, her academic performance is also quite good, she likes to go to museums to see exhibitions to get a lot of interesting knowledge. She is very fond of being a stewardess and has many qualifications as a stewardess. The job that one wants to look for is an
accord with oneself hobby because oneself time is more had better can harvest a lot of work. Do not have an excessive requirement to oneself salary but the requirement is relatively safe a few. I don't think much about the distance because there's a shuttle bus.

From the above introduction to Sunny, it can see that she is a girl with a lot of connotation. From her appearance, it can see that her noble temperament is also very good-looking. She is also interested in museums. As you can see, her social skills may be normal, with a score of five being appropriate. In terms of working hours, it should be possible to work longer hours and work in the form of mental + physical work. Because she is a girl, she may not want her work to be too overworked, and the risk factor is relatively low. Therefore, Sunny is more suitable to do some jobs in the service industry, such as waiters in high-end hotels or restaurants, museum guides, or etiquette teachers.

Person 5: Jack is a sophomore in high school. In the summer vacation, he wants to find a job related to his future major. He was interested in business and served as President of the business society at his school. He will spend a lot of time learning some knowledge of economics and some principles of finance. He has a nice personality and is very receptive to others and loves chatting online. He's not very good at formal face-to-face communication because he gets very nervous. He set up a club in his school to try to run a fruit tea shop, from which he gained a lot of business experience and wanted to be more realistic. He doesn't much want to work for others, preferring a freelance career.

From the above introduction to Jack, it can find that he is a person with a lot of personalities and he is very interested in the field of finance. He's not very good at face-to-face communication because he's nervous, but he's good at talking to other people online so his social skills are rated around 6. Because he is a sophomore in high school, he will not spend much time on this job, but he will put a lot of energy into it. Because he wants to find a job he loves, so he should not be too tired. He had some experience in running a small business at school, and the major he was interested in coincided with it. His type of work is primarily brain-based, and he has high expectations for the value he can create. From the above analysis, it can be seen that Jack is more suitable to start his own business because he is very creative and doesn't like being tied down. At the same time, he also likes the work of finance very much and has some experience in operation. Therefore, I think he is more suitable for the job of the WeChat business because the work form is relatively independent and he is also interested in this aspect.

Person 6: Noe is a sophomore in high school. He has good physical strength, so he hopes to find a job with partial physical strength. He is cheerful and likes to deal with people. And now it is the summer vacation, Noe has a lot of time to do part-time jobs. Physical jobs include librarians, couriers, flyers, restaurant waiters, snack bar salesmen, restaurant waiters, lifeguards, and tour guides. Moreover, Noe is outgoing and good at socializing with others, so he prefers a job where he can communicate with others, which also means that he is more suitable for a job with a high score in social skills. In both to conform to the physical work, and to meet the higher social index in work, and help to find the guide social ability is 7 points, museum announcer need social skills is eight points, distributing leaflets need social skills is 6 points, thus guides the work both belong to the physical work and can meet with people, although it takes a long time to complete, due to the summer vacation, Noe have time to finish the work, so according to the above description can be concluded that guide the work is more suitable.

Person 7: Ethan is a sophomore in high school. He is taciturn and doesn't like to socialize with others. In his spare time, he likes to delve into the knowledge of computers and programming. At the same time, he liked to work indoors because he was not very good at sports and did not want to work with physical labor. Among the occupations listed were programmer, translator, accountant, tutor, freelance writer, WeChat business, barista, and photographer. In this work, programming technician need social skills is 0 points, social skills needed for the translation for the three points, accounting needs social skills for 1 minute, tutoring the social skills of 8 points, social skills needed for the WeChat business for 6 minutes, coffee technicians needed social skills for the three points, social skills needed for the photographer to 4 points. According to Ethan's personality, it can be concluded
that a job with a high social ability score is not suitable for him, so tutors and WeChat businesses are excluded.

**Person 8:** Jennifer is a girl in the second year of high school. She is cheerful and good at talking with others. She wanted an indoor job with a low-risk index because she didn't like manual labor and jobs that were too dangerous. Since she wants to major in media and art, she prefers a job related to media, photography, and video. Among all the jobs, baristas, photographers, programming technicians, translators, accountants, models, we-media, tutors, freelance writers, WeChat business, and etiquette are the ones with a low-risk index, and most work indoors. And since the jobs of barista, programmer, translator, accountant, and tutor don't fit in with her professional field, I don't think they are suitable for her. Among the remaining work of photographer, model, we media, freelance writer, WeChat business and etiquette, the profession with high social ability is "we media" with 8 points, freelance writer with 7 points, WeChat business with 6 points, etiquette with 5 points, a model with 3 points and photographer with 4 points. Because Jennifer has strong social skills and can adapt to jobs with high social skills scores, the three jobs of modeling, photographer, and etiquette were excluded. In the remaining work, I think "we Media" is more suitable for her professional field, and according to the above analysis, "We Media" is more suitable for her.

**Person 9:** Rina, a senior three student, hopes to find an internship this summer. Rina is an excellent student at school and is the monitor of her high school class. She is also very outgoing and likes to share ideas and opinions with others. She doesn't want to take up a manual job because her sport isn't very good. Rina has to go to school in her spare time, so she hopes to find a part-time job working on weekends. Among all the occupations, photographers, we media, WeChat business, freelance writers and etiquette have more flexible working hours and can arrange their working hours freely. Rina has strong social skills, so she hopes to engage in a job that focuses on social interaction. In these jobs, the social ability required by the photographer is 4 points, we media is 8 points, the tutor is 8 points, WeChat business is 6 points, a freelance writer is 7 points and etiquette is 5 points. Therefore, the jobs with high scores of social ability are we-media, tutor, and freelance writer. Because of Rina's excellent academic performance and cheerful personality, we finally come to the conclusion that she is more suitable for the job of a tutor.

**Person 10:** Jupiter was a senior three student. He was tall and good at sports and jobs that involved physical labor. As he will graduate this summer vacation, he has plenty of time to take a part-time job. He hopes to take up an outdoor job because he doesn't like a job where he sits in a room all the time doing things. Jupiter is average in social skills. He loves talking to people but occasionally finds his topics too strange, so he wants a job where he doesn't communicate too much. Among the jobs that meet Jupiter's requirements are librarian, Courier, flyers, restaurant waiter, cafeteria salesman, and lifeguard. Since Jupiter is a senior in high school, he hopes to find a job with less work so that he can have more time to relax or apply for college. Librarians were rated as being 2 tired, couriers as being 7 tired, flyers as being 2 tired, restaurant waiters as being 7 tired, grocery store salespeople as being 6 tired, and lifeguards as being 6 tired. So four jobs were eliminated: delivery man, restaurant waiter, lifeguard, and cafeteria salesman. In the rest of the work, according to Jupiter's personal conditions, finally came to the conclusion that distributing leaflets was the most suitable job for him.

4. **Conclusion**

This paper, it has made a reasonable and effective model for high school students to choose summer internship. It first took into account the fact that everyone has his or her own preferences, which are difficult to quantify accurately. The Analytic Hierarchy Process (AHP) that is a method that can quantify very subjective factors precisely. By quantifying these factors, it is possible to recommend a suitable summer internship for each student. It randomly selected ten typical students and then used the designed model to recommend them. The results were satisfactory. Compared with other methods, our method has the advantages of strong robustness and can make different recommendations for different characteristics of each student. This method of quantifying subjective factors can be used in
many other fields, such as emotion measurement and preference prediction. Analytic hierarchy process (AHP), as a method to quantify subjective factors, can be applied to a wider range of methods.

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