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Application of Job Safety Analysis in the Safety Management of Off-Campus Internship in Environmental Geological Engineering

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Abstract: Off-campus internship is an important part of the training in environmental geological engineering. The main difference of internship for environmental geological engineering major compared to internship programs is that these internships are usually in the field and there are safety risks due to natural, social, biological, and other factors. The purpose of this study is to summarize the safety risks through work safety analysis and propose corresponding preventive measures, so as to make the internship program safer.

Keywords: Job Safety Analysis; Off-campus internship; Safety management

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1. Introduction

According to the talent cultivation mode of "cultivating people in the landscape," we aim to cultivate students' core ability of geological mapping in the field by refining their professional skills in the natural environment of the landscape and shaping their comprehensive ability of understanding, analyzing, and solving problems in real projects in the field. This is a necessary means and measure for environmental geological engineering majors, but the internship process is risky in terms of safety and prone to potential risks.

The internship base is located in the southwestern part of Liaoning Province on the coast of Bohai Sea, which has rich geological characteristics. This makes it an excellent location for learning geological mapping, tectonics and mineral deposits. The main contents of the internship program are as follows: (i) visual identification and description of minerals and rocks; (ii) observation and description of outcrops in the survey area; (iii) description of geological routes and geological observation points; (iv) preparation of letter hand sections and actual stratigraphic sections; (v) regional geological mapping, etc.

2. Characteristics of off-campus internship

2.1. Long field internship time, difficult to manage

The length of an off-campus internship site is four weeks. During this period, students will be subjected under

an unfamiliar environment instead of their campus. The internship base is a famous scenic area near the sea, so it is difficult to place any restrictions on the students during their free time, and students inevitably come into contact with society [1]. However, students have little social experience, and they do not know the local customs and lifestyle. Students are often impulsive, so they might cause conflicts and other potential risks.

2.2. Dangerous wildlife

The off-campus internship base is located at the seaside hills on the eastern edge of the Black Mountain hills in western Liaoning. The elevation is generally 20–500 m, with a relative height difference of 200–350 m. The highest point is located in Jiulong Mountain in the northwest of the prefecture-level city, with an elevation of 558.7 m. During the field practice, students have to go deep into the mountains and hills, where there are poisonous snakes and insects, making it dangerous for the students.

2.3. Psychological issues

The change of environment may bring many psychological changes. In addition, compared to on-campus teaching, the field internship is very difficult because of the hot weather, harsh environment, and long working hours. Nowadays, many students lack physical fitness and a hard-working attitude, so they might experience psychological issues during the internship program [2,3].

2.4. More sudden safety risks in off-campus internships

In addition to the safety hazards above, there are also other hazards like landslides, mudslides, or injuries. In addition, because field internships are conducted in big batches, there are often issues like physical exhaustion and people falling out of line.

3. Job safety analysis implementation process

According to the procedure of the job safety analysis method, there are three stages to the safety control of field internships: pre-event safety assessment, in-event safety protection, and post-event safety feedback.

3.1. Pre-event safety assessment

3.1.1. Semi-open-ended interview

The author drew up a semi-open interview outline, including the following questions: what do you think are the potential risks of off-campus internships, and what preventive measures that are taken in each segment?

3.1.2. Formation of job security analysis team

We selected 5–8 people from our teaching managers, professional teachers, practical training administrators, counselors, internship base managers, students, and other people to form an internship safety risk analysis group. The staff members in the group all had rich experience in guiding internship training, among which the professional teachers were double-qualified teachers who have worked in enterprises for more than ten years and have guided this kind of internship program for many years; the students are the students who are going to participate in this internship in the last term in this internship base.

3.1.3. Introduction to job safety analysis content

The meaning, main objectives, considerations, and procedure of Job Safety Analysis was explained to the job safety analysis team members. After that, a blank Job Safety Analysis form was distributed to the group

members, and they were provided with an explanation of its contents and the logical relationship between them. They were also given guidance on how to fill out the form.

The Job Security Analysis covers the following aspects: first, the assessment of those responsible for security. This includes assessing whether the instructors, internship managers, or counselors are qualified for the task. Additionally, it examines whether the internship guidance team possesses adequate capacity to ensure continuous supervision of all students throughout the internship period. Secondly, the safety of the internship site was assessed. Whether field visits have been made to the internship site, including aspects such as the terrain, topography, wildlife species, and bodies of water such as marine beaches and marshes. Third, the assessment the participating students' abilities were evaluated. This includes whether the physical fitness, history of physical or mental illnesses, and many more. Fourth, the assessment of the safety of the internship process. This includes whether the content of the internship is appropriate, whether the internship involves very dangerous locations, whether the daily internship tasks are too heavy, etc. The fifth aspect evaluated is the ability to handle accidents. This involves assessing whether there is an ample supply of emergency medicine available, whether timely external assistance can be sought, whether accident insurance has been procured, and whether there are medical facilities and resources near the internship site. Sixth, the transportation, the accommodation, and the food safety were assessed [4-6].

3.1.4. Pre-event assessment

Through pre-event assessment, the safety risks of off-campus internships were identified as follows:

Firstly, there were safety risks due to natural causes. In this case, the location of the field internship is in the northeast region. The specific place of operation is in the field, and the environment is difficult and there are many uncontrollable natural factors. Therefore, natural causes can become an important potential risk. There are mainly two types of common risks, one is a geological disaster, including rock falls, landslides, mudslides, etc.; the other is catastrophic weather, including high temperature, heavy rain, strong wind, lightning, etc. These risks can be avoided through understanding the pattern of occurrences of these phenomena.

Secondly, social reasons are also a potential risk in this internship program. Social reasons include traffic accidents, food, and health safety incidents, personnel conflicts, and property safety issues that may occur during field internships. The risk increases as the field internship involves frequent travel by car or on foot, and the internship site has mountainous roads and poor road conditions. In addition, most of the students participating in the internship are not local people, so they do not know much about the local customs. Furthermore, the students are young and enthusiastic, so they might cause conflicts with the locals [7].

The third potential risk is wildlife. Various poisonous plants can be found in the internship site such as acacia, wild apricot, and poisonous celery. However, the students' curiosity and lack of necessary discriminatory skills may lead to poisoning incidents. Furthermore, since this internship takes place in June each year, the hot weather and increased activity of poisonous insects pose risks. Additionally, encounters with wild bees, poisonous snakes, or domestic animals in the field are also possibilities, leading to potential risks such as mosquito bites, poisonous snake bites, wild bee stings, and injuries from domestic animals during the internship.

The fourth potential risk of field internships is caused by personal reasons. Personal reasons include injuries, sickness, non-compliance with the internship management regulations, or negative emotions. Falls and sprains happen from time to time during the field internship, and serious falls like falling off a cliff lead to unimaginable consequences. Some students often have diarrhea, fever, sore throat, heatstroke, etc. because of poor health or unconvincing soil. There have been students who do not comply with the rules of the internship

management, left the team, got lost in the field, swim in the sea without permission, drowned, etc [8]. Bad moods, such as depression, fatigue, homesickness, and maladjustment to the environment are also potential safety hazards.

3.2. In-event safety prevention

3.2.1. Safety management process

To prevent potential risks during the field internship and ensure the successful completion of the tasks, it is essential to implement thorough safety management throughout the entire internship process. We drew a flow chart of the safety management of field internship based on the Job Safety Analysis and our school's condition (**Figure 1**).

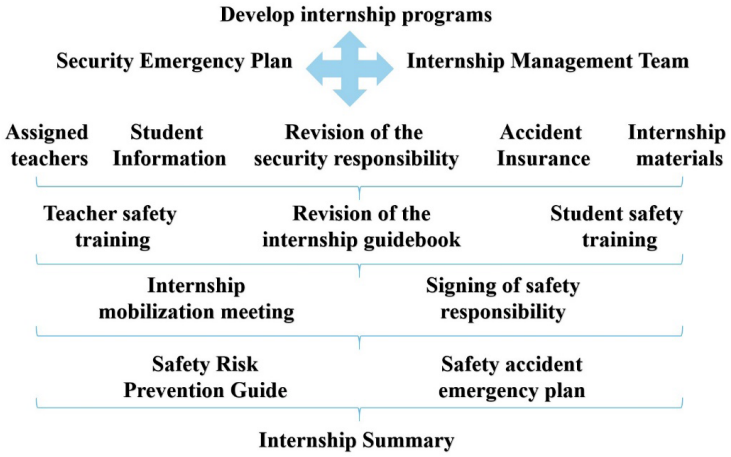

Figure 1. Workflow of safety management of field internship

3.2.2. The main points of prevention in each stage

Compared to pre-event safety assessments, in-event safety precautions need to be implemented in every detail.

(i) Material preparation

Personal protective gear includes such as clothing and footwear, sunscreen, insect repellent, heat stroke, and other items. Team protective gear includes pathfinding tools, positioning tools, marking tools, etc. Emergency items, such as necessary drugs, whistles, life jackets, are also needed.

(ii) Preparation of the mind

Targeted safety training should be provided to students. Discipline should be emphasized during practical training to ensure that the students do not get lost; local customs and traditions should be taught to prevent conflicts between the students and local residents. Moreover, education on natural geography and the local environment, and emergency response measures should also be provided.

(iii) Safety protection

For traffic safety, first of all, instructors must conduct a field survey beforehand to ensure the safety of the route. Secondly, the vehicles used needs to be in good condition, and it is important to do a headcount before taking off. It is also important to perform headcounts while trekking, and the group should act as a unit, have smooth communication, and have enough food and water. Unexpected situations should not be handled hastily. The amount of work in a day should be arranged reasonably and everyone should return to their accommodation before dark.

3.3. Post-event safety evaluation

Taking this off-campus internship as an example, we divided the potential risk causes of off-campus internship into natural social, biological, and personal reasons, evaluated the probability of their occurrence according to different risk factors and manifestations, and proposed corresponding prevention guidelines.

(i) Natural causes

Floods, lightning, strong winds, hail, and hot weather are all weather-related factors. According to our analysis, these phenomena are all prone to occur, with hot weather being the most likely. Therefore, the precautions taken are as follows: pay attention to weather forecasts in advance, return to base immediately in thunderstorms, stay away from dangerous areas (such as under large trees, utility poles, riverside, seaside, etc.), stay away from dangerous objects, try to avoid going out during hot weathers, use sunscreen, wear a hat, carry anti-heat medication such as patchouli.

(ii) Social causes

Based on our assessment, traffic accidents are prone to occur. Therefore, the precautions taken are as follows: the vehicles used must adhere to certain specifications. It is also important to strictly abide by the traffic rules, wear seat belts when riding in the car, march in a single line during the hike, always watch out for motor vehicles, and prohibit chasing around on the road. Secondly, conflicts lead to arguments and possibly fights. To prevent that, the participants should be educated on local customs to prevent conflict. Besides, fighting and brawling should be prohibited and other disciplinary rules should be set up. The teachers should be immediately notified when conflict arises. Loss of property or thefts are also prone to occur. Therefore, it is important for the participants to take care of their belongings at all times. Food poisoning is also prone to occur. Therefore, it is important to pay attention to food hygiene, washing hands before meals, not eat outside the base, and not pick and eat fruits of wild plants.

(iii) Biological causes

Injuries caused by wildlife such as bites from mosquitoes, poisonous snakes, wild bees, are prone to occur. Therefore, participants should wear long-sleeved clothes, long pants, and high boots suitable for fieldwork. Besides, participants should pay attention to the presence of wild animals when working and avoid them. Training on first aid should also be given, necessary first aid tools should be prepared and medical attention should be given when injuries occur. Accident insurance should also be purchased. Secondly, injuries from domestic animals, such as bites from domestic cats and dogs are also very likely to occur. Precautionary measures: Do not tease domestic animals, stay away from cats, dogs, and other domestic animals, seek medical attention immediately if injuries occur, and purchase accident insurance.

(iv) Personal reasons

Personal reasons include physical illnesses, such as colds, diarrhea, and other diseases. Probability assessment: highly likely to occur. Therefore, students should pay attention to their physical condition and inform the teachers in time if they are feeling unwell. Students should also carry around some common medicines. Secondly, accidents like sprains, falls, and getting lost are prone to occur. Therefore, it is important to buy accident insurance, wear shoes suitable for fieldwork, pay attention to foot safety, carry emergency medicine, and seek help or medical attention in time. Thirdly, bad mood, such as depression, fatigue, and homesickness are prone to occur. Hence, teachers should pay attention to their students' emotions, organize some recreational activities after daily tasks are completed, and talk to them if needed.

4. Conclusion

Off-campus internship is an important part of the teaching of environmental geological engineering. Through

field observation and field survey, the theory of geology is combined with practice, and through practice, disciplinary thinking is cultivated and professional skills are mastered. Job Safety Analysis is used to make a comprehensive assessment of the internship process and corresponding preventive measures are formulated, which greatly improves the safety of the internship.

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Author contributions

T.B. conceived the idea of the study. Y.L. wrote the paper.

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