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Factors that Influence Learning during a Scientific Field Trip in a Natural Environment

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Abstract

This study deals with the educational effectiveness of field trips. The main purpose was to obtain insight concerning factors that might influence the ability of students to learn during a scientific field trip in a natural environment. The research was conducted in the context of a 1-day geologic field trip by 296 students in Grades 9 through 11 in high schools in Israel. The study combined qualitative and quantitative research methods. Data were collected from three different sources (student, teacher, and outside observer) in three stages (before, after, and during the field trip). Using observations and questionnaires we investigated: a) the nature of student learning during the field trip, b) student attitudes toward the field trip, and c) changes in student knowledge and attitudes after the field trip. Our findings suggest that the educational effectiveness of a field trip is controlled by two major factors: the field trip quality and the "Novelty space" (or Familiarity Index). The educational quality of a field trip is determined by its structure, learning materials, and teaching method, and the ability to direct learning to a concrete interaction with the environment. The novelty space consists of three prefield variables: cognitive, psychological, and geographic. The learning performance of students whose "Novelty Space" was reduced before the field trip was significantly higher than that of students whose "Novelty Space" had not been so reduced. Thus, the former group gained significantly higher achievement and attitude levels. It is suggested that a field trip should occur early in the concrete part of the curriculum, and should be preceded by a relatively short preparatory unit that focuses on increasing familiarity with the learning setting of the field trip, thereby limiting the "Novelty Space" factors.

Science education is conducted predominantly in three types of learning environment: classroom, laboratory, and outdoors. The outdoor environment is the one most neglected by teachers, curriculum developers, and researchers. In reviewing the literature published since 1930, Mason (1980) found only 43 empirical studies that dealt with cognitive and affective outcomes of outdoor education. Most of these studies compared field trips with another teaching method. Another subset of articles reported that teachers tended to avoid outdoor activities because they were frequently unfamiliar with the philosophy, technique, and organization of field trips (Fido & Gayford, 1982; McCaw, 1980; McKenzie, Utgard, & Lisowsi, 1986). The lack of curriculum materials relevant to this type of activity is another major factor that inhibits teachers from conducting field trips (Hickman, 1976; Mirka, 1970).

During the last 2 decades, there has been increasing interest regarding school visits to informal science education centers such as science museums, zoos, aquariums (e.g., Donald, 1991; Eratuuli & Sneider, 1990; Feher, 1990; Stevenson, 1991). McClafferty and Rennie (1992)

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reviewed 39 studies published between 1974 and 1992. These studies neither investigated factors that influence students' ability to learn in an outdoor setting nor focused on the implementation of field trips as an integral part of the science curriculum.

Thomas and O'Donoghue (1990) noted that one of the primary recommendations of the International Symposium on Fieldwork in the Sciences was: ". . . to develop appropriate pedagogic techniques based on knowledge of how children learn . . ."(p. 201). It would seem that this neglected state of outdoor education reflects our limited knowledge and understanding of the outdoors as an effective learning environment. Thus, it is suggested that, to improve the planning and execution of purposeful field trips, research should focus on better understanding the outdoors as a learning environment. In this respect, a series of studies (Falk, 1983; Falk & Balling, 1982; Falk, Martin, & Balling, 1978; Martin, Falk, and Balling, 1981) focused on the psychological aspect of the field trip. These studies demonstrated that the ability of students to conduct cognitive tasks during a field trip depends on the familiarity of the field trip setting. For example, they showed that the learning performance of students acquainted with the field trip location was significantly better than those not as familiar. Whereas the students in the "acquainted" group concentrated on the learning assignments, the students in the other group were involved mainly with exploring the physical surround. Similarly, Gottfried (1979) reported that students who were asked to conduct learning tasks in an unfamiliar setting were first involved in sensorial operations, and only at a later stage could some of them conduct analytic operations. However, a lack of familiarity with the field trip setting is only one novelty factor affecting students' learning ability. Orion (1984) identified three other factors of concern on the basis of a case study concerning the learning performance of high-school students during a 4-day field camp: previous knowledge of basic concepts relevant to the field trip, previous outdoor experience, and previous acquaintance with the field trip location.

The main goal of this study was to obtain insight into the outdoors as a learning environment, for the purpose of assisting curriculum developers and teachers as they develop and implement field trips integrally related to the curriculum. The objective of this study was to identify critical factors that may influence a student's ability to learn during a field trip in a natural setting. Based on earlier studies, which emphasized the influence of preconditioning factors on the learning performance in the field trip setting (Falk et al., 1978; Orion, 1984), and upon our experience in outdoor education, we propose that the following categories of factors might influence a field trip's learning event (this categorization was later validated by an expert judgment procedure):

- teaching factors, such as the place of the field trip in the curriculum structure, didactic methods, teaching and learning aids, and quality of teachers;
- field trip factors, such as the learning conditions at each learning station, duration and attractiveness of the trail, and weather conditions during the field trip; and
- student factors, such as previous knowledge of trip topics; previous acquaintance with trip area, previous experience in field trips, previous attitudes to subject matter, previous attitudes to field trips, and class characteristics (e.g., grade, size, and major studies.).

As will be explained later, the research design enables the elimination of the "field trip factors" and some of the "teaching factors" (i.e., the teaching and learning method and the teaching and learning aids).

In this study, we investigated the students' and teachers' prior involvement in field trips and the influence of these prior characteristics on student performance during this field trip and its outcomes. More specifically, we wished to determine the contribution of the following factors to students learning during field trips:

(a) Student's maturation (grade).
(b) Initial attitudes of students toward field trips.
(c) Initial attitudes of students toward the subject matter (geology).
(d) Initial knowledge of students directly pertaining to the field trip's learning assignments.
(e) Previous experience of students in learning-oriented field trips.
(f) Previous geographic acquaintance of students with the field trip area.
(g) Type of students' preparation for the field trip.
(h) The location of the field trip in the curriculum scheme.
(i) Class characteristics in terms of heterogeneity and size.
(j) The teacher's scientific background and his or her field-teaching experience.

Description of Field Trip under Investigation

The geologic field trip under investigation can be defined as a structured field trip in a natural environment. It was developed as an integral part of an introductory geology course for high-school students. The route (from the foothills to the Judean mountains) was divided into seven learning stations, selected according to criteria described by Orion (1989, 1993). The design was based on the following criteria:

(a) didactic desirability: gradual development from the concrete to the abstract, with consideration of factors that influence learning ability in the field;
(b) administrative: ease of organization;
(c) educational: the field trip as a concrete learning event; and
(d) curricular: the teaching of basic concepts through concrete activities.

The field trip was based on a module consisting of a preparatory unit, a 1-day field trip, and a summary unit. The curriculum materials developed for the field trip included a teacher's guide for the preparatory unit, a field trip booklet that directed the individual investigation of the students at each learning station, and a series of mini-posters to help the teacher explain field observations during the group discussion that followed the individual investigation. The field booklet included instructions, assignments, and space to write the student's finding and conclusions.

The first learning phase consisted of an individual investigation, which was conducted in teams of 2 to 3 students. In this learning phase, the students were directed by the field booklet to deal with two types of assignments. The first set of assignments included questions directing the students to investigate the geologic exposure by using activities such as identification of rocks, soils, and minerals, observation of concrete geologic phenomena, and drawing of geologic cross sections. The second set of assignments included more abstract questions that required the students to explain their findings: for example, "Which rock layer is the oldest and which is the youngest?" or "What can you conclude from the inclined position of the rock layers that you identified earlier?".

After the individualized stage, the teacher conducted a large group discussion to summarize the various assignments. The work at each station concluded with open questions for further thought and reflection. For example, the station at which students identified a fold structure ended with the question, "How were those hard layers folded?". After the students concluded that a columnar section consists of five different marine sedimentary rocks, the open question raised was, "What caused the change of sediment types?". These open questions later served as advanced organizers for the more abstract part of the curriculum, which would take place back in the classroom. For a detailed description of the model for the development of field trips as an integral part of the science curriculum, its implementation, and the curriculum package developed for the field trips, refer to Orion (1989, 1993).

Methods

Sample and Preparation for the Field Trip

The research population consisted of 296 students from 8 high schools in Israel (Table 1). Only students who completed all the questionnaires and tests were selected from a total of 500 geography majors in 17 classes Grades 9 through 11. The research population was heterogeneous with respect to grade and type of preparation for the field trip.

Grade. The student population consisted of two subgroups composed of Grades 9 and 10 and Grade 11. In Israel, all students learn the same curriculum until Grade 11. Specialization in specific disciplines starts from Grade 11. Therefore, classes of Grade 11 are smaller and more homogeneous than those of grades 9 and 10.

Preparation for the Field Trip. The population consisted of three subgroups, based on the type of preparation they obtained. This information was obtained from the self-reports by teachers. The following classification was based on length and emphasis of the preparation and place of the field trip in the curriculum scheme:

"Optimal Concrete" Preparation Group (OCP).

This subgroup consisted of six Grade 11 classes ($N = 98$) who followed the entire model presented by Orion (1993), namely, a 10-hour teaching preparatory unit, field trip, and summary unit. The preparatory unit consists of three components:

(a) Cognitive preparation: This was based on hands-on activities involving the learning of basic concepts and skills required for the completion of the field trip's assignments. These activities included a workshop with kits of rocks, minerals, soils, and fossils, which the students would investigate later in the field and which focused on developing the skills and knowledge needed for identify these materials; microscopic investigation of the rocks' microstructure, as well as sedimentation processes; and laboratory experiments and simulations that explained processes and phenomena, including crystallization, chemical weathering, springs, and sedimentation.

Table 1
Preparation Groups of the Research Population

Type of preparation	Number of students	Number of classes by grade	
		9–10	11
Optimal concrete	98		6
Minimal concrete	101	2	3
Traditional frontal	97	3	3

(b) Geographic preparation: This was conducted using assignments such as locating the learning station and the route of the field trip on a map, drawing a topographic cross section of the field trip area from a topographic map, and observing slides and videotapes of the field trip's area.
(c) Psychological preparation: This involved presenting students with a detailed description of the forthcoming learning event with respect to details such as the length of the whole field trip, the duration of work at each learning station, the place and duration of the breaks, expected weather, a detailed description of the learning requirements at each learning station, and a presentation of the field learning materials and visuals of the route and the different learning stations.

"Minimal Concrete" Preparation Group (MCP)

This subgroup consisted of three Grade 11 classes and two Grades 9 and 10 classes (N = 101), who experienced the field trip at the earlier stages of the learning scheme. However, their preparatory unit was shorter (about 4 h) and included only part of the cognitive preparation, namely, the earth materials workshop and a few of the laboratory experiments. This subgroup was not prepared either psychologically or geographically for the field trip.

"Traditional Frontal" Preparation Group (TFP).

The third subgroup consisted of three Grade 11 classes and three Grades 9 and 10 classes (N = 97), who studied the entire course in geology (30 h) in a conventional manner and only later participated in the field trip. The teachers of this group perceived the field trip in the traditional way, namely as a summary or as enrichment to the entire course. Field trip topics were taught at least 1 month before the event. The students had not acquired skills in rock and soil identification, because the course did not include hands-on activities. Special preparation, either psychological or geographic, for the event was not given.

Design and Procedure

To control for variables associated with the three categories (teaching factors, field trip factors, and student factors), the study was conducted using the same field trip under identical learning and physical conditions for each of the participating groups. Thus, the field trip factors, the teaching and learning method, and the teaching and learning aids were similar. The independent variables were the student factors (e.g., previous knowledge of trip topics, previous acquaintance with the field trip area, previous experience in field trips, previous attitudes to subject matter, previous attitudes to field trips, class composition, and class size), the location of the field trip in the curriculum structure, and the background of the teacher in the subject matter and field teaching experience.

To investigate the influence of these factors on student performance and learning ability during the field trip, both qualitative (observations and interviews) and quantitative techniques (questionnaires and tests) were used. The combination of both qualitative and quantitative methods is based on several works advocating such a combined method (Cook & Reichardt, 1979; Firestone, 1987; Fraser & Tobin, 1992; Howe, 1988). Fraser and Tobin (1992) mentioned noteworthy reasons for employing this combined method:

> ". . . the complementarity of qualitative observational data and quantitative data added to the richness of the data base as a whole. . . . Through a triangulation of quantitative data

> and qualitative information, greater credibility could be placed in findings because they emerged consistently from data obtained using a range of different data collection methods." (p. 290)

The data were collected from three different sources (student, teacher, and outside observers) at three stages (before, after, and during the field trip). Figure 1 describes the variables assessed in each of the research stages.

This research scheme enabled us to identify students' knowledge and attitudes after the field trip and to relate them to the event itself, as well as to the students' background factors (e.g., grade and previous field experiences) and level and type of preparation for the field trip.

Instruments

The research questions were investigated using seven different inventories, which were developed or modified for this study. The inventories included a student background questionnaire, three different attitude questionnaires, an achievement test, a structured observation schedule, and a teacher's self-report:

Inventory 1: Student Background Questionnaire. This questionnaire was developed for this study and administrated before the field trip. It included informative questions about student characteristics such as age and gender, as well as their previous outdoor experiences. One of the main objectives of this inventory was to collect information about previous student experiences in a structured field trip similar to the geologic one under investigation. Because students in Israel experience primarily ordinary field trips, which focus on the recreational and social

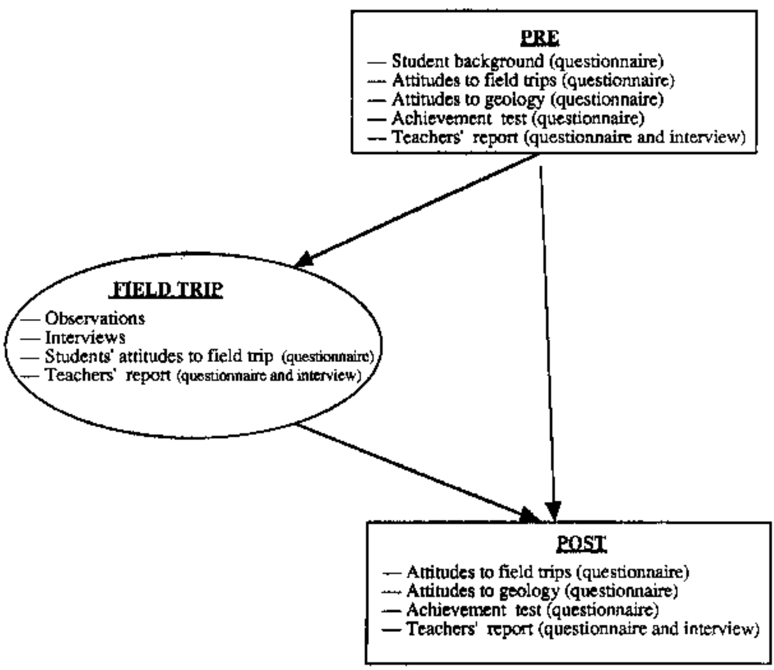

Figure 1. Research design.

aspects of being out of doors, and rarely experience "learning" field trips, a detailed description of such a learning field trip was included in the questionnaire. The researchers who administrated the questionnaires were instructed to read this paragraph out loud to the whole class to facilitate students' understanding of our definition of a "learning" field trip as opposed to an "ordinary" field trip.

Inventory 2: Attitudes toward Field Trips in General (GFT-AT). This Likert-type questionnaire included 32 items concerning five categories: the field trip as a learning tool; individualized learning as a learning method during a field trip; the social aspect of field trips; the adventure (recreational) aspect of field trips; and the environmental aspects of field trips. The instrument used a 4-point scale: 4 = strongly agree, 3 = agree, 2 = disagree, and 1 = strongly disagree.

The development of the inventory included the following six stages: conceptualization, item formulation, content validation via expert judgment, statistical analysis—construct validity stage A (factor analytic investigation and Cronbach's α reliability coefficient), comparison of the expert's judgment with the statistical analysis, and statistical analysis—construct validity stage B (factor analytic investigation and Cronbach's α reliability coefficient of the improved questionnaire). Following these procedures, the inventory was found to be valid and reliable (Orion & Hofstein, 1991). Table 2 presents the Cronbach's α reliability coefficients of the five scales of the inventory and sample items. A detailed description of the development of the inventory and its sensitivity can be found in Orion and Hofstein (1991).

This inventory was administrated twice. The pretest was conducted at the beginning of the year, at least 1 month before the teachers started to prepare the students for the field trip. The posttest was conducted a few days after the students had participated in the field trip.

Inventory 3: Attitudes toward a Specific Field Trip the Students Had Experienced (SFT-AT). This Likert-type questionnaire included 23 items in four categories: enjoyment and interest of the field trip, the quality of teaching and teaching and learning aids used in the field trip, the learning efficiency during the field trip, and the physical difficulty of the field trip. The instrument used a 4-point scale: 4 = very high, 3 = high, 2 = low, and 1 = very low.

This inventory was also developed following the same six developmental stages as described earlier. Following these procedures, this questionnaire was also found to be valid and reliable (Orion, 1990). Table 2 presents the Cronbach's α reliability coefficients of the four scales of the inventory and sample items. This inventory was administrated at the end of the field trip.

Inventory 4: Attitudes toward Geology (GEO-AT). A semantic differential questionnaire was administrated. This commonly used questionnaire, which was modified after Osgood, Suci, and Tannenbaum (1975), included 18 items composed of opposite pairs arranged in relation to a 7-point scale. The items were grouped and analyzed in relation to three scales:

- The cognitive aspect of the discipline. This domain includes 6 pairs, such as difficult–easy, clear–unclear, and understandable–not understandable; its Cronbach's reliability coefficient was found to be $\alpha = 0.75$.
- The "affective" domain. This domain includes 6 pairs, such as interesting–boring, encouraging–frustrating, and enjoyable–not enjoyable; its Cronbach's reliability coefficient was found to be $\alpha = 0.84$.

Table 2
Description of Two Attitude Questionnaires Developed for the Current Study

Inventory	Dimensions	Number of items	Cronbach's α coefficient	Sample items
Attitudes toward field trips in general GFT-AT	(a) The field trip as a learning tool	12	0.87	The field trip helps in the understanding of material learned in classroom.
	(b) Individualized learning as learning method during a field trip	3	0.62	Working individually during a field trip is important for understanding the learning subjects.
	(c) The social aspect of field trips	8	0.71	What I like best in field trips are the jokes told by my friends.
	(d) The adventure aspect of field trips	4	0.78	What I like best in field trips is the adventure (e.g., climbing mountains, crossing rivers).
	(e) The environmental aspect of field trips	6	0.77	I like to go on field trips, because it is important for me to understand the environment in which I live.
Attitudes toward a specific field trip SFT-AT	(a) Enjoyment and interest of the field trip	7	0.82	To what extent was the field trip enjoyable; or to what extent were the teacher's explanations interesting?
	(b) The quality of the teaching during the field trip and the teaching and learning aids	9	0.81	To what extent were the teacher's explanations understandable; or to what extent were the instructions in the field booklet clear?
	(c) Individualized learning during the field trip	6	0.72	To what extent of collaboration were my team's members involved in solving the learning assignments; or to what extent was I successful in solving the questions of the field booklet?
	(d) The physical difficulty of the route	2	0.87	How physically difficult was the field trip?

- The "usefulness" domain. This domain includes 6 pairs, such as important–unimportant, necessary–unnecessary, and useful–not useful, its Cronbach's reliability coefficient was found to be $\alpha = 0.84$.

This inventory was administrated twice, several days before the students participated in the field trip and few days after the trip.

Inventory 5: Achievement Test. The achievement test was developed for the present study. It included 17 multiple-choice questions, one open-ended question, and one geographic orientation question. This test was designed to determine the extent of student knowledge before participating in the field trip, ascertain the preparation of the students for the field trip, and assess the extent and type of knowledge gained following the field trip. To achieve these objectives, this test was administrated twice, once during the last lesson before the field trip, and again during the first lesson after the field trip. The test included two categories: (a) concepts and skills that should or could be learned in the classroom or laboratory before participating in the field trip, and (b) concepts and skills that could be learned only through the concrete field-based experience.

The first part of the test included 12 questions, which can be divided into two subcategories:

(a) Six questions relating to identification of rocks, minerals, and soils. These questions enabled us to evaluate to what extent the students had been prepared with respect to knowledge and skills needed for conducting some of the learning assignments in the field.
(b) Six questions relating to subjects that are usually taught by teachers without the aid of practical concrete experiences. This category included multiple choice questions.

These 12 questions enabled us to distinguish among three different types of preparation for the field trip: "concrete" preparation, which was based on practical experiences; "frontal" preparation, which was based on lectures; and a mixture of both types.

The second part of the inventory included seven questions relating to phenomena and processes that could only be observed in a concrete manner during the field trip. Some of the questions involved recall of facts, such as:

Which of the following rock combinations can be found in Judean Mountains?
1. Limestone, dolostone, sandstone, red loam.
2. Sandstone, red loam, beach rock, dunes.
3. Limestone, marl, terra rosa, inclined layers.
4. Dolostone, chalk, basalt, horizontal layers.
5. I do not know.

Other questions involved in a deeper understanding of the geologic processes. For example,

The following drawing describes a geologic cross section of a particular area. How many stages were involved in construction of the geologic structure described in the drawing? List, in the correct order, as many geologic stages as you can reconstruct.

The achievement test underwent a content validity procedure conducted by eight well-experienced earth science educators. The internal reliability of the test was determined by using Cronbach's α coefficient, which was found to be 0.84. The following findings support the validity and the reliability of the achievement test:

- The teachers' reports about their preparation style for the field trip were found to agree with the results of their classes with respect to the three preparation categories of the test.
- The analysis of the pretest of the whole population revealed that the mean score of the category involving questions relating to the preparation for the field trip was signifi-

cantly higher than the category involving questions relating to phenomena and processes that were learned only during the field trip.

- The analysis of the posttest of the whole population revealed a significant gain of knowledge following the field trip. However, the average score for the category involving subjects covered in the preparation for the field trip was significantly lower than the average score for the category involving phenomena and processes that were learned only during the field trip.

The third section of the inventory included a question dealing with the geographic orientation of the students and their acquaintance with the geographic districts of the field trip. This question included a topographic cross section of the field trip area. A list of eight geographical districts was given, and the students were asked to choose only those districts that were included in the cross section, and to write them on the drawing in their proper places.

Inventory 6: Observation Protocols. Three observation tools were used in this study: (a) a standard structured observational schedule, (b) open interviews, and (c) videotaping.

The observation schedule for the current study was based on the earlier experience of the authors in observing students during a field trip (Orion, 1984). Because conditions in the field do not allow extensive writing, the schedule was designed as a table of 14 columns printed on a single sheet of paper. The following are the titles of the schedule's columns: (a) number of the learning station; (b) climate conditions during the activity in the learning station; (c) general description of the students' learning performance during the individual–cooperative learning at the station; (d) description of student social behavior during the individual–cooperative learning at the station; (e) impression of the extent of interest and enthusiasm showed by the students during their work; (f) impression of the extent of understanding showed by the students during their work; (g) distribution of the time spent in individual vs. cooperative learning; (h) general description of the whole group discussion with the teacher; (i) impression of the extent of interest showed by the students during group discussion; (j) a list of the questions asked by the students during the group discussion; (k) impression of the extent of understanding showed by the students during the group discussion; (l) duration of the group discussion; and (m) general comments.

Soon after the field trip, the observer wrote a short report regarding the event based on the collected data. Three observers conducted all observations. To test the consistency of the observations, the first field trip was observed simultaneously by all. The analysis of the three observation schedules revealed similar results.

Most of the observers were student teachers, and these observations were part of their training. The students were not aware that the notes taken by the observers and their questions were also a part of research; as a result, the observers' presence did not interfere with or influence student performance. The interviews were conducted during the field trip as a friendly conversation, which were written down a short time later. A few of the field trips were also videotaped and later analyzed.

Inventory 7: Teacher's Self-Report. This report was modified for the current study, on the basis of a questionnaire that was initially developed and validated by Tamir (1983). This questionnaire enabled us to collect the following information:

- How were the students prepared for the field trip (for example, the content of the preparation, the subjects and skills covered in the preparation, the exact activities included in the preparation, and hours of teaching)?

- What was the place of the field trip in the curriculum structure?
- What was the teacher's evaluation of the students' performance during the field trip?
- Did the teachers enjoy the field trip?
- What was the teacher's opinion of the cognitive and affective influence of the field trip on students (as shown in the classes after the field trip)?

Data Analysis Procedures

The qualitative data collection protocols were described previously. These data were analyzed using cross-case inductive analysis (Patton, 1990). The observation protocol, interview transcriptions, videotape, and teacher's report of each class were read and analyzed individually by two researchers. Each entry was read initially with no coding or comments noted. During a second reading patterns that emerged from the data were recorded, and the general students' learning performance was placed in categories based on the emergent patterns. After an additional individual reading to confirm or negate categories, two researchers met to compare and negotiate the categories. In all of the cases, the researchers arrived at an agreement between the different sources of information. This clear pattern eased the interpretation task and led to similar categories for each of the classifications suggested by the two researchers. Following this classification procedure, three learning performance levels were established, as will be described later.

The analysis of the quantitative data was conducted using the following statistical tests:

A paired *t*-test analysis was employed to compare pre- and post-test attitudes and achievements of students. A nonpaired *t*-test analysis was employed to compare mean attitudes and achievements of different subgroups. A one-way analysis of variance was used to compare more than two subgroups.

A stepwise multiple regression analysis was used to determine how variance in the students' pre–field trip and field trip variables accounted for the students' learning efficiency during the field trip. The stepwise analysis was programmed first to analyze the pre–field trip variables, and then to analyze the field trip variables.

Results

Analysis of the observational data revealed that the classes observed could be divided into three categories with respect to their learning performance during the field trip:

- High learning performance, including classes in which more than two thirds of the students demonstrated a high level of on-task performance, and in which their off-task behavior was negligible. This was shown through their concrete interaction with the surroundings; most of the students were involved with their team's members in solving the learning tasks, and about half of the students actively involved in the summary discussion. The individual and summary discussions were relatively long, each lasting about 20 min.
- Moderate learning performance characterized classes in which two thirds of their students demonstrated on-task performance during the individual learning phase while the others were involved in off-task behavior; only about 40% were actively involved in the summary discussion. In both stages, the amount of the students involved in on-task behavior gradually decreased. After 15 min of individual learning most of the students were involved in off-task behavior. In regard to the summary discussion, such off-task behaviors were observed, for most of the students, after 5 to 10 min.
- Poor learning performance characterized classes in which most of their students were

involved in off-task behavior during the individual learning and the summary discussion.

The first category includes classes that demonstrated high learning performance in each of the learning stations. The following is a typical description of a class of 20 students in learning station No. 2:

> After arriving at learning station No. 2, the teacher grouped the class and in the next three minutes gave them clear instructions about their assignments. In this stage, some of the students noticed that they identified the location from the slides they watched in the classroom. In the next two minutes the students were organized into 5 teams (without the assistance of the teacher) of 2–4 members (two students worked individually). All the teams were given a hammer, a bottle of hydrochloric acid and bags for collecting rocks and soil. They opened the booklets and started to work following the booklet's instructions. In this stage, about 80% of the students approached the rocks, took samples and identified the samples as a team effort. Almost all of the students took an active part in the identification process, and they did it quite skillfully and rapidly. They went to their teacher to verify their conclusions and later continued to answer the subsequent questions in the booklet. At this stage, each team sat together on the ground and discussed the questions. Most of the students in each team were highly involved in the learning process and contributed explanations or questions. All the groups faced the exposure and from time to time some of the students approached the rocks in order to point out their observations. In some of the teams, disagreements among the members led to very loud discussions. At this stage, the teacher walked among the teams to assist them. After about 20 minutes, when most of the students completed their tasks, the teacher assembled them for a summary discussion. Approximately 50% of the students participated actively in this discussion. About 30% of the students listened passively to the teacher and wrote notes. About 20% of the students lost concentration and stopped listening after about five minutes and just looked around or sat with closed eyes. After 20 minutes, the teacher concluded the discussion. The relationship between teacher and students was open and some times even friendly.

The observer conducted open conversations with a sample of 10 students from this group during the day. All of them were very enthusiastic, as shown by their responses:

> I have never experienced such a field trip before; it was very enjoyable and we learned a lot.
>
> It is a lot of fun to learn out of doors. Everything was so clear . . . It is very helpful when you can see everything in the front of your eyes.
>
> I prefer learning in such a way and I hope that all our classes will be like this.
>
> I was very satisfied with myself . . . I could identify all the rocks and I helped my friends in solving the questions.
>
> It was a lot of fun . . . I enjoyed being with my friends . . . I think that I learned a lot today.

This category included six 11th-grade classes. Analysis of the reports of the teachers of these classes reveals that all of them underwent the field trip after "Optimal Concrete" preparation. The teachers' point of view concerning the event were very positive as well, and they were very impressed with their students' performance and behavior in the field. They also mentioned that students demonstrated more interest in the geology classes that followed the field trip.

The secondary category includes classes that showed moderate learning performance in each of the learning stations. The following is a typical description of a class of 20 students in learning station No. 2:

> After arriving at learning station No. 2, the teacher grouped the class and in the next three minutes gave them clear instructions about their assignments. The students were quite noisy at this stage and about half of them were more interested in social interaction than in listening to the teacher. About six minutes passed until the students organized into teams. Although the teacher asked them to work in small teams of 2–3 students, they organized into larger teams of 5 students. All the teams were given a bottle of hydrochloric acid and bags for collecting rocks and soil and some had a hammer. They opened the booklets and started to work following the booklet's instructions. At this stage, only about 60% of the students took an active part in the process of approaching the rocks, taking and identifying samples following the booklets' instructions. The other 40% were not involved in this activity. Some of them simply broke rocks with the hammer or dropped acid on the rocks with no purpose. Others were occupied in social interaction. Those who identified the rocks and the soil did it quite skillfully, and identified them in few minutes. In the second stage, gradually, an increasing number of students left the learning activity. After about 15 minutes, the teacher noticed that most of the students were not active and assembled them for the discussion. For the first 8 minutes, most of the students listened to the teacher and about 40% responded to his questions. After 10 minutes the teacher had to finish this discussion, since the students lost interest in the discussion. The teacher–student relationships were quite open until the last few minutes of the discussion when the students stopped listening.

The observer conducted open conversations with 10 students of this group during the day. In general, these students expressed positive attitudes about the field trip. Some of them used expressions similar to those of students in first category, such as:

> It is a lot of fun to learn out of doors.
>
> Everything was so clear . . . It is very helpful when you can see everything in the front of your eyes.

However, some of them indicated some difficulties. For example:

> In general, it was fun and we learned a lot, but some of the stations were too long and the teacher talked too much.
>
> I enjoyed working with my friends . . . some of the assignments such as rock identification were very good; however, others were difficult and frustrating.

This second category, with moderate performance, included five classes from Grades 9 through 11. Analysis of teachers' reports reveals that all of them underwent the field trip after a "Minimal Concrete" preparation. The teachers' point of view concerning the event was very positive, and they were satisfied with their students' performance in the field in comparison with their previous experiences in "regular" field trips with other classes.

The third category included classes that demonstrated poor learning performance in each of the learning stations. The following is a typical description of a class of 20 students at learning station No. 2, as given by the observer:

> After arriving at learning station No. 2, the teacher grouped the class and in the next three minutes gave them clear instructions about their assignments. The students were very noisy in this stage and most of them were more concerned with social interaction than in listening to the teacher. The students did not organize into teams and they stood in one group in front of the rocks. About 60% of the students showed no interest with the activities and were highly involved in social activity. The others tried to follow the instructions of the field booklet. However, none of them approached the exposure nor used the identification tools. They gathered around the teacher and tried to identify the rocks and soil by random guessing. After 5 minutes, the teacher noticed that most of the students were not active and assembled them for a summary discussion. During his summary, the teacher was frequently interrupted by students and after five minutes he had to stop since most of the students were occupied with talking and even those who wanted to listen could not do so. . . .

This behavior repeated itself in all of the learning stations, and consequently, the teacher–student relationships were hostile.

The observer conducted open conversations with 10 students of this category. In general, these students expressed negative attitudes about the field trip as a learning event, as shown by the following responses:

> It is very boring; we already learned all of this three months ago.
>
> We already finished learning this subject . . . we had a test about it.
>
> It was not interesting at all; I only came for the fun and the enjoyment of being with my friends out of the classroom.
>
> We have to learn about rocks in the classroom, but during a field trip, . . . come on! . . . we came for fun.

This category included five classes from Grades 9 to 11. Analysis of teachers' self-reports from these classes revealed that all of them participated in the field trip at the end of the entire course without any concrete preparation. The teachers' point of view concerning the event was very negative, and some of them even claimed that a field trip is not a useful learning environment.

Two additional factors that might have had an influence on the learning ability of the students were analyzed through the observational data:

(a) Teachers' background—the experience of the teachers in teaching in the field and their general geologic background: Eight classes were taught in the field by their regular geography teachers. The other nine classes were taught by professional geologists who had considerable experience in teaching out of doors. Six of these classes were taught by the same professional field instructor. Two of the six classes had "OCP" preparation, two had "MCP" preparation, and two had "TFP"-type preparation. Analysis of the observers' reports concerning these classes revealed that the students in each behaved and performed in a manner typical of their preparation category, as described earlier. Analysis of the observations concerning the geography teachers revealed the same phenomenon, namely, "OCP"-type classes, which were taught in the field by their inexperienced geography teachers, showed high learning performance, whereas "TFP"-types classes showed low learning performance even when taught by trained field instructors.

(b) Class size: The 11th-grade classes consisted of 20 to 25 students, whereas the 9th- and 10th-grade classes consisted of 35 to 40 students. However, small 11th-grade "TFP"-type classes performed much more poorly than the 11th-grade ones of "OCP" type and the 9th- and 10th-grade classes of "MCP" type.

It seems that the teachers' experience and class size did not act as a central determinant of field trip effectiveness. This is not to suggest that these factors are not important; in fact, they are as important in the field as in the classroom. It is suggested, however, that the structured field trip with all the learning and teaching materials neutralized the influence of these two factors to a considerable degree and made the type of preparation the dominant factor.

The qualitative findings suggest that there are relationships between students' learning performance during a specific field trip and the way in which they were prepared for it, as well as the place of the field trip in the curriculum. Classes that participated in the field trip at the earlier stage of the course, after a short and focused preparation that included cognitive, psychological, and geographic aspects, performed the best. An entirely opposite performance was found among classes that used the field trip in the traditional approach, as a summary event without any specific preparation. It seems that the low performance of these classes was influenced by the lack of concrete cognitive preparation, as well as the psychological and the geographic preparation.

The fact that all classes demonstrating the highest learning performance were 11th-grade ones also might suggest that the age factor had some influence in addition to the preparation factor. This assumption will be tested quantitatively in the next section.

The quantitative analysis had three objectives:

(a) to distinguish between the influences of the preparation factor and the grade factor,
(b) to investigate the influence of student performance in the field trip on their attitudes and achievements; and
(c) to identify the most influential factors that influence student performance in the field.

Distinction between Preparation and Grade Variables

In a previous study, Orion (1990) found that the OCP group and the 11th-grade group significantly enhanced both their knowledge and attitudes in comparison with the other preparation and grade groups for many domains tested. Because the OCP subgroup only included 11th-grade classes, there was an overlap between the variables of grade and preparation. In other words, it is not clear whether the positive findings concerning the OCP group resulted from the preparation or from maturation or both.

To discriminate between the influence of grade and preparation, two independent sets of analyses were conducted. The first analysis included a comparison of two subgroups from different grades, which underwent the same preparation type to control for the preparation variables. The second analysis included a comparison of two subgroups from the same grade that underwent different preparation to control for the grade variable.

Comparison of the Two Grade Groups that Underwent Similar Preparation

This comparison was conducted between a subgroup of 110 Grades 9 and 10 students who underwent MCP and TFP and a subgroup of 80 11th-grade students who underwent the same two types of preparation.

Table 3
t-Test Analysis between the Two Grade Subgroups in Relation to Their Posttest Attitudes and Achievement Outcomes

Inventory	Scales	9th and 10th (N = 110) Mean	SD	11th (N = 80) Mean	SD	t	p
General attitudes toward a field trip GFT-AT (Likert 1–4)	Learning tool	3.2	0.5	3.3	0.5	1.6	NS
	Individualized learning	2.45	0.6	2.6	0.6	1.8	NS
	Adventurous aspect	2.7	0.7	2.95	0.6	2.5	.01
	Social aspect	2.8	0.5	2.75	0.4	1.1	NS
	Environmental aspect	3.0	0.5	3.0	0.5	0.6	NS
Attitudes toward geology GEO-AT (Semantic Differential 1–7)	Cognitive domain	4.6	0.9	4.7	0.9	0.6	NS
	Affective domain	4.7	1.0	4.9	1.0	1.8	NS
	Usefulness domain	5.2	1.1	5.4	1.0	1.3	NS
Attitudes toward a specific field trip SFT-AT (Likert 1–4)	Enjoyment and interest	3.0	0.5	3.1	0.5	1.9	NS
	Teaching quality and teaching and learning aids	3.2	0.4	3.0	0.5	3.0	.003
	Individualized learning	3.0	0.4	2.8	0.5	3.4	.001
	Physical difficulty	3.2	0.8	3.4	0.7	1.4	NS
Achievement test (1%–100%)	Identification of rocks	58.5	29.5	54.0	29.3	1.0	NS
	Formation of rocks	64.6	21.5	68.8	25.1	1.2	NS
	Questions related to field phenomena	56.8	21.9	59.3	19.9	0.8	NS

Note. NS = not significant.

On a basis of a *t*-test analysis that revealed no significant differences between the two age subgroups in relation to the pretest outcomes of the achievement test on any of the attitude variables, a *t*-test analysis was employed to compare the posttest outcomes of these subgroups. Table 3 shows that no significant differences were found between the two age subgroups in relation to the three achievement subtests and to their attitudes to studying geology (GEO-AT inventory). From the five domains of the GFT-AT inventory, only the adventurous domain showed a significant difference between the subgroups. In relation to their attitudes toward the geologic field trip they had experienced, in two of the four domains of the SFT-AT inventory, the attitudes of the younger subgroup were found to be significantly higher than the older subgroup.

If the grade variable were more important than the preparation variable, then one would expect that attitude and knowledge levels of 11th-grade classes would be significantly higher than those of their 9th- and 10th-grade counterparts. Although there are slight differences related to grade, these results suggest that this variable had only a small influence.

Comparison of Different Preparation Types Groups of Similar Grade

The three preparation subgroups of the 11th-grade students were analyzed using one-way analysis of variance. The results revealed no significant differences between the MCP group and the other two subgroups. Therefore, a *t*-test analysis was employed to compare two 11th-grade

Table 4
t-Test Analysis between the Two Preparation Subgroups in Relation to Their Posttest Attitudes and Achievement Outcomes

Inventory	Scales	OCP (N = 55)		TFP (N = 56)			
		Mean	SD	Mean	SD	t	p
General attitudes toward a field trip GFT-AT (Likert 1–4)	Learning tool	3.4	0.5	3.25	0.6	2.5	.01
	Individualized learning	3.0	0.5	2.6	0.6	3.1	.002
	Adventurous aspect	2.8	0.6	2.9	0.6	0.7	NS
	Social aspect	2.6	0.5	2.75	0.4	1.3	NS
	Environmental aspect	3.0	0.6	3.0	0.5	0.2	NS
Attitudes toward geology GEO-AT (Semantic Differential 1–7)	Cognitive domain	4.7	0.9	4.7	0.9	0.3	NS
	Affective domain	5.0	1.0	5.1	1.0	0.5	NS
	Usefulness domain	5.5	1.1	5.4	1.2	0.6	NS
Attitudes toward a specific field trip SFT-AT (Likert 1–4)	Enjoyment and interest	3.1	0.4	3.1	0.5	0.1	NS
	Teaching quality and teaching and learning aids	3.2	0.3	3.0	0.5	2.6	.01
	Individualized learning	3.1	0.3	2.8	0.5	3.7	.0003
	Physical difficulty	3.2	0.8	3.45	0.7	1.6	NS
Achievement test (1%–100%)	Identification of rocks	71.8	25.6	55.3	30.0	3.1	.002
	Formation of rocks	71.8	20.5	68.5	24.3	0.8	NS
	Questions related to field phenomena	67.7	18.0	58.3	20.9	2.5	.01

Note. OCP = Optimal concrete preparation; TFP = traditional frontal preparation. NS = not significant.

groups, one drawn from the OCP group, and the other from the TFP group. A pretest analysis revealed no significant differences in attitudes registered in pre–GFT-AT inventory and the GEO-AT inventory. In relation to the achievement test, as might be expected, the scores of the OCP group were found to be significantly higher than those of the TFP group. Table 4 presents the t-test analysis comparing the post–field trip test outcomes between these two subgroups.

The results presented in Table 4 indicate that in relation to the two learning domains of the GFT-AT inventory (namely, *field trip as a learning tool* and *individualized learning during a field trip*) and the two learning domains of the SFT-AT inventory (namely, *the teacher and the teaching and learning aids* and *the learning efficiency during the specific field trip*), the mean attitudes of the OCP group were found to be significantly more positive compared with the TFP group. No significant differences were found in the other domains of these two inventories and in the three scales of the GEO-AT inventory.

Both groups gained knowledge after the field trip. In the Rocks Identification subtest, the scores of the OCP group increased from M = 61.0 to M = 71.8, and the scores of the TFP group increased from M = 35.0 to M = 55.3. In the Rock Formation subtest, the scores of the OCP group increased from M = 60.0 to M = 71.8, and the scores of the TFP group increased from M = 54.1 to M = 68.5. In the subtest that included questions related to field phenomena, the scores of the OCP group increased from M = 44.1 to M = 67.7, whereas the TFP group's scores increased from M = 42.5 to M = 58.3.

The data presented in Table 4 indicate that although the TFP students gained some knowledge and skills, a significant gap in rock identification abilities remained and, most important, the scores of the OCP students concerning the questions related to field phenomena were found to be significantly higher than the scores of the TFP students.

The findings summarized in Table 4 suggest that preparation toward a field trip has a significant influence on students' learning ability. The performance of students who were prepared by studying a unit that focused on the three novelty (familiarity) factors was significantly higher than that of the other students. This finding was strongly supported by the observational reports. The significant difference in the ability of students to solve problems related to field phenomena reflects the knowledge gained through the field trip. Thus, it appears that students who participated in the field trip after an adequate concrete preparatory learning phase could cope more successfully with the new problems that they faced in the field. The ability of the OCP group to better cope with the learning assignments was also reflected in their attitudes and knowledge after the field trip.

Nevertheless, the TFP students also gained some knowledge and, in general, they enhanced their attitudes toward the field trip. However, compared with the other group, they only fulfilled a part of the potential of the field trip as a learning event.

Stepwise Multiple Regression Analysis

A stepwise multiple regression analysis was conducted as another statistical method to identify the variables that may affect learning during a field trip (Table 5). The regression analyzed 20 different independent variables, which were compiled from the data collected by all seven inventories used in this study. The variables included:

- background variables: grade, gender, and students' previous experiences in "ordinary" field trips emphasizing the social and adventurous aspects of the field trip.
- pre–field trip variables: the five domains of the GFT-AT inventory, the three domains of the GEO-AT inventory; student scores in relation to the three parts of the achievement test; and students' acquaintance and orientation of the geography of the field trip region, as measured by a question included in the achievement test, and the type of preparation as induced from the teachers' self-reports.

The regression analysis also included four field trip variables: the field trip instructor (professional field instructor vs. the regular geography teacher), student attitudes toward the teacher and the teaching and learning aids, the students' enjoyment of and interest in the field trip, and the physical difficulty of the field trip.

The dependent variable was represented in the multiple regression analysis by the variable *learning efficiency during the field trip,* as measured through the SFT-AT inventory. This variable, which reflects the students' attitudes toward their individualized learning during the field trip, was chosen because the main purpose of a learning field trip is the direct interaction between the student and the concrete environment. Thus, the individualized learning level can be seen as an indirect measure of the students' learning ability in the field.

Five independent variables explained 40% of the total variance. Only one of the field trip variables—*teacher and teaching and learning aids,* which explains 15% of the total variance—influenced student learning efficiency during the field trip. This variable relates to student attitudes toward the teaching and learning components of the field trip (such as quality of the booklet that guided their individualized learning, mini-posters used by the teacher, team learning, class discussion, and the field trip teacher). Three pre–field trip variables, *preparation for*

Table 5
Multiple Regression of Background, Pre–Field Trip, and Field Trip Variables and Relations of Student Attitudes to Their Learning Efficiency during the Field Trip (N = *296*)

Independent variables	Variable group	β	ΔR^2	R^2	F (ΔR^2)	p (F)
Teacher and teaching and learning aids	Field trip variables (Variable No. 19)	0.40	0.15	0.15	60	.0001
Preparation for field trip	Pre–field trip variables (Variable No. 15)	0.10	0.10	0.25	30	.0001
Field trip as a learning aid	Pre–field trip variables (Variable No. 7)	0.20	0.09	0.34	22	.0001
Student score of geographic cross section of field trip area	Pre–field trip variables (Variable No. 6)	0.09	0.03	0.37	7	.01
Grade	Background variables (Variable No. 2)	−0.15	0.03	0.40	9	.002

field trip, attitude toward the field trip as a learning aid, and *the geographic acquaintance and orientation with the field trip area* explained 22% of the total variance and one background variable; grade only explained 3% of the variance. This finding supports the previous conclusion that grade has only a small effect on learning efficiency during a field trip.

Field trip preparation was classified based on teacher self-reports concerning the subjects they taught before the field trip. A correlation test (Pearson r) between this variable and all the other pre–field trip variables showed significant correlation for only two of the variables: (a) achievement in rock identification ($r = 0.25$, $p = 0.02$) and (b) achievement in "rock formation environments" ($r = 0.3$, $p = 0.0001$). Thus, it appears that these variables represent the cognitive preparation for the field trip.

Discussion

Based on the results obtained from this study, one can gain insight into the factors that influence the educational effectiveness of field trips. The qualitative data (observations) clearly indicate differences between the learning performances of different classes during the field trip. The quantitative data indicate that student achievement and attitudes reflect their extent of learning performance during the field trip. Although all the groups showed positive attitudes and gained some knowledge after the field trip, those classes that performed better in the field achieved significantly higher scores on the knowledge test and gained more positive attitudes than the others. The research strategy enabled us to eliminate the contribution of many of the 22 potential variables that were tested in this study, and reveals the factors that had a predominant influence on the learning ability of students during the field trip. It is reasonable to surmise that because all the field trip factors and two of the teaching factors (e.g., method and aids) were identical for all the groups and no significant influence was found for the "quality of teacher" factor, the cause for difference in students performance should have emerged from the student factors and one teaching factor, that of "place of the field trip in the curriculum structure."

The data obtained from the teacher self-reports and the information questionnaire, together with the observational data, enabled us to relate the students' learning performance in the field trip to their pre–field trip variables. The most pronounced variable, however, was the one that dealt with the type of preparation to a field trip. Statistical analysis indicates that factors such as class size, grade, and previous attitudes toward the subject matter had only limited effects on students' performance during the field trip. The most influential factors are related to the preparation of students for the field trip and the place of the field trip in the curriculum structure. It is suggested that these findings provide more insight to the notion of *novelty factor* first suggested by Falk et al. (1978).

It seems that a lack of familiarity with the field trip setting is only one novelty factor affecting learning ability. On the basis of multiple regression analysis, at least three pre–field trip variables were found to influencing student learning efficiency during a field trip. These three variables are very similar to the variables identified by Orion (1984) while conducting a case study on the learning performance of three high-school classes during a 4-day geologic camp in a desert area in Israel.

The variable, "preparation for the field trip," which is mainly related to the type of knowledge the students acquired before the field trip, is similar to what Orion (1984) identified as a "previous knowledge" factor, because both are related to the students' cognitive readiness for the learning event. The variable, "student attitude to field trip as a learning aid" is comparable with the "previous outdoor experiences" of Orion (1984), because both are concerned with the psychological readiness for a field trip as a learning event. The variable "geographic acquaintance and orientation with the field trip area" is identical to the "acquaintance with the field trip area" of Orion (1984).

The novelty of the field setting seems to consist, of at least three novelty factors: cognitive, geographic, and psychological novelty. Cognitive novelty depends on the concepts and skills that students are asked to deal with throughout the field trip. Geographic novelty reflects the acquaintance of the students with the field trip area. Psychological novelty of the population in this research reflected their previous experiences in field trips as social–adventurous events rather than learning activities.

On the basis of this conclusion it is suggested that the term "novelty factor" previously suggested by Falk et al. (1978) might be expanded to the term *novelty space*. The novelty space notion might have an important implication for the planning and conducting field trips. It could be used to define the specific preparation required for an educational field trip. Preparation addressing all three novelty factors can maximize familiarity and thus facilitate meaningful learning during the field trip. In cases where teachers cannot find the time fully to prepare their students for a field trip, identifying the specific novelty space of the class involved and then adapting the level and the length of the learning activity during the field trip could lead to an improvement of the educational value in such a field trip.

We suggest that the lower performance and results of the TFP group and the higher performance and results of the OCP group also reflect the educational advantages of placing the field trip in earlier stages of the curriculum as a means for concretization.

Even those students who went on the field trip with a wide novelty space gained some knowledge and skills and showed a positive attitude toward the field trip as a learning event. This finding may indicate the usefulness of a well-designed field trip, which directs the students to concrete interaction with the environment.

Thus, learning efficiency during the field trip might be influenced by three main sources: (a) the place of the field trip within the curriculum; (b) the extent of the students' novelty space (or familiarity space) while going on the field trip; and (c) the field trip program—for example, learning materials, structure, and teaching and learning strategies.

Summary and Implications

The field trip is one of the most complex and expensive activities in the educational system. Therefore, it is important to achieve optimal educational results that will justify the investment.

The variables influencing learning efficiency in the field fall into three groups: background, pre–field trip, and field trip. Some of them are related to the teaching variables, some to the students, and some to field trip components. In addition to the field trip variables, only three variables were found to have a significant influence on the learning ability of students. These three variables are associated with student characteristics before the field trip, namely:

(a) level and type of knowledge and skills,
(b) acquaintance with the field trip area, and
(c) psychological preparation.

These factors define what we called the novelty space for a student who is participating in a field trip. The novelty space concept has a very clear implication for planning and conducting field trips. It defines the specific preparation required for an educational field trip. Preparation that deals with the three novelty factors can reduce the novelty space to a minimum, thus facilitating meaningful learning during the field trip. The cognitive novelty can be reduced directly by several concrete activities: for example, working with the materials the students will meet in the field, as well as simulation of phenomena and processes through laboratory experiments. The geographic and psychological novelties can also be reduced indirectly in the classroom: first, by slides and films and working with maps, and second, by detailed information about the event, such as purpose, learning method, number of learning stations, length of time, expected weather conditions, expected difficulties along the route, and so forth.

The psychological novelty factor of the population in this research is explained by their previous experiences in field trips as social–adventurous (recreational) events rather than learning activities. It can be assumed that as such students are exposed to learning field trips, the effect of this psychological factor will decrease considerably.

Although it is impossible fully to prepare students for the field trip, identifying the specific novelty space of the class involved, and then adapting the level and the length of the learning activity during the field trip, could lead to improvement in the educational value of the field trip.

The field trip should be placed early in the concrete part of the total learning activity, and should be focused mainly on concrete interaction between the students and the environment. The field trip, together with the preparatory unit, can constitute an independent module that might serve as a concrete bridge toward more abstract learning levels. Thus, a field trip should be planned as an integral part of the curriculum rather than as an isolated activity.

It is important to remember that the findings and conclusion mentioned in this article are valid for 1-day field trips in a natural environment. It is reasonable to suggest that many of the conclusions may also be relevant to other out-of-school environments, such as museums, zoos, factories, and urban areas. However, it is also likely that each outdoor environment has some unique characteristics that curriculum developers and teachers should take into account. We suggest that a detailed classification of the outdoors as a learning environment, according to factors that influence educational effectiveness, is needed.

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