Effect of 5E Based Instructional Approach on Achievement and Interest in Social Studies among Grade IX Students

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Abstract

The 5E (Engage, Explore, Explain, Elaborate, and Evaluate) is an instructional model which provides a framework for a constructivist, guided inquiry approach and enables the learners to create or invent different ideas over the conventional one. The study focuses on the effect of the 5E based instructional approach on the achievement and interest in social studies among Grade IX students. The specific design used here was Pre-test or Post-test equivalent group design with the self-constructed and validated tools. The findings of the study revealed that there is a significant effect of the 5E based instructional approach on the interest and achievement in social studies between girls less than 14 years and 14 and above years of age of Grade IX learning through a 5E based instructional approach.

Introduction

The 5E is an instructional model of constructivism. It was developed in 1980s by the Biological Science Curriculum Study (BSCS), to help students to perceive and apprehend the concepts of science productively. The 5E instructional model promotes new learning and understanding the concepts in depth. As the name suggests 5E which represents five phases, i.e., Engage, Explore,

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Explain, Elaborate, and Evaluate (as illustrated in Fig. 1). Each of these phases contribute to the teacher's well-reasoned and structured instructions. It also enables learners to develop scientific temper and empower them with the required 21st century skills. Priorly, 5E models were used as linear progression.

But as per the new next generation model of 5E, the process is not a linear progression as every step includes basic steps to be followed. For example, engaging itself includes exploration. Explaining also involves components of exploration and there is evaluation involved in each step. So, it is not a linear process as each stage includes the essence of the other steps.

In the engagement phase, students are exposed to a stimulating

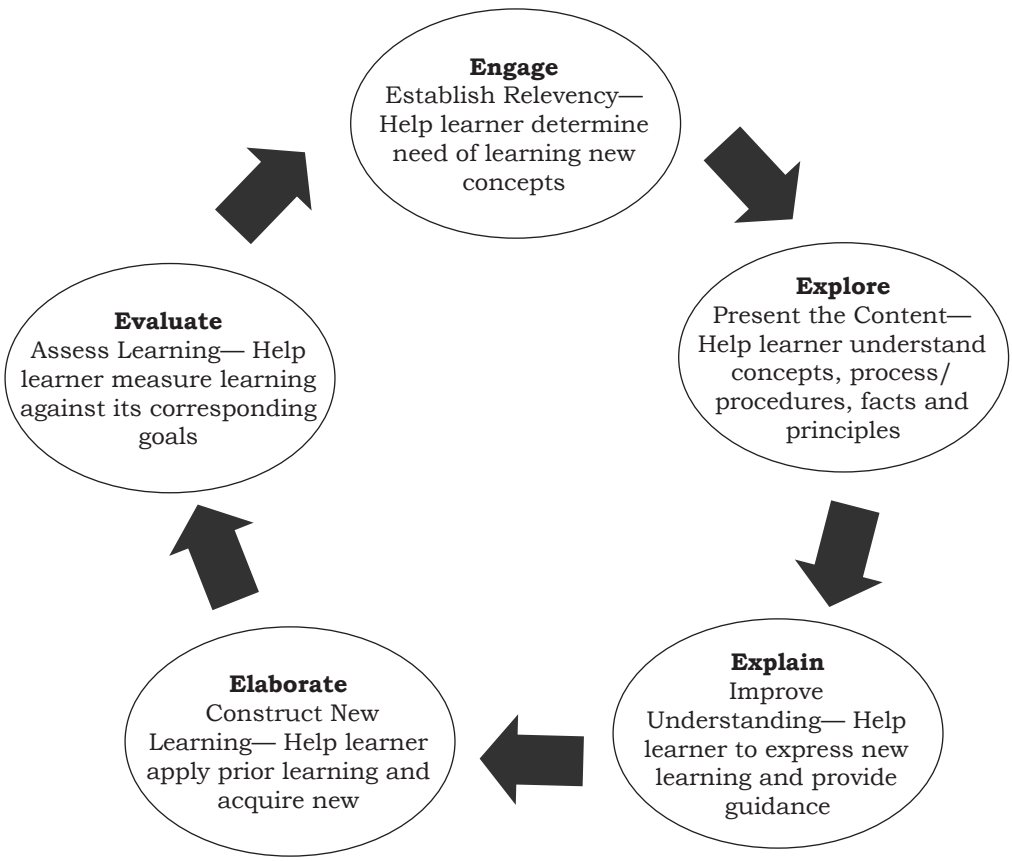

Fig. 1: Showing the process of the 5E Instructional Approach
(Source: Adapted from 5E Instructional Model for eLearning Preferred by NASA http://www.swiftelearningservices.com/5e-instructional-model-for-elearning-a-model-preferred-by-nasa/)

environment or a real-life situation which seeks their attention and generates learning curiosity among them. In this phase, new knowledge or topics are introduced by adopting different activities and strategies such as drama, songs, models, stories, or videos which triggers learners' interest and motivates them to learn. The exploration phase is the phase of learning by doing where hands-on or minds-on activities are performed with scaffolding. The exploration phase is an application of what the students have learned, builds on, or extends their understanding by developing models, drawing, clippings, narratives, or even songs. Teachers pose a question to students to apply what they have learned. Explanation phase is a combination of engagement and exploration wherein a teacher introduces appropriate scientific techniques of the concept in relation to the student's perception and experiences. Students are asked their opinion in different scenarios. Here students can answer higher-order thinking questions. It is a phase of understanding the concepts and deducing it. And, if there is any misconception, that too is cleared in this phase. Elaboration phase is a phase of application of what students learned. By extending the understanding, learners can apply knowledge in real life situations and can explore more to reason their hypotheses. Problem solving tasks, investigation, experimental inquiry, decision making, and thinking skill activities are very beneficial for students to move ahead and learn more. Evaluation phase is a very valuable phase as it not only assesses the students learning but also assess the process of learning. It shows the learner's degree of understanding at every stage. It answers about what and how students learned. This phase provides complete information on students' mastery of learning.

There are various approaches to facilitate knowledge construction and the 5E model is one of the most effective instructional approaches for teachers to enable student's knowledge construction. Therefore, the aim of this study was to find out the effect of the 5E based instructional approach on the achievement and interest in social studies among Grade IX students. Answers to the following hypotheses were sought within the framework of these overall objectives.

Objectives

1. To design 5E based instructional designs in social studies for grade IX students.
2. To study the effect of the 5E based instructional approach on achievement in social studies of Grade IX students.
3. To study the effect of the 5E based instructional approach on interest in social studies of Grade IX students.
4. To study the age related differences in the achievement in social studies among Grade IX

students learning through 5E based instructional approach.

5. To study the age related differences in the interest in social studies subject among Grade IX students learning through 5E based instructional approach.

Hypotheses

1. **Ho 1.** There is no significant effect of the 5E based instructional approach on achievement in social studies of Grade IX students.
2. **Ho 2.** There is no significant effect of the 5E based instructional approach on interest in social studies of Grade IX students.
3. **Ho 3.** There is no significant difference in the achievement in social studies between girls less than 14 and 14 and above years of age of Grade IX learning through a 5E based instructional approach.
4. **Ho 4.** There is no significant difference among girls of less than 14 years of age and above 14 years of age in Grade IX to learn through 5E based instructional approach.

Methodology

This study was an experimental one wherein true experimental design, i.e., pre-test or post-test equivalent group design was used. This study considers the 5E instructional approach as an independent variable and achievement and interest as the dependent variables. In addition, the investigators assumed age and IQ level as the intervening variables that could influence independent and dependent variables. To bring equivalency to both the groups the investigators conducted the IQ test.

Table 1
Design of the Study

Random assignment of the group	Matching of one-to-one subject	Pre-test	Treatment	Post-test
Experimental group	Intelligence Test (Nathan Haselbauer, 2005)	Achievement and Interest test in Social Studies	Learning through 5E instructional approach	Achievement and Interest test in Social Studies
Control group	Intelligence Test (Nathan Haselbauer, 2005)	Achievement and Interest test in Social Studies	Learning through traditional approach (lecture method)	Achievement and Interest test in Social Studies

Sample of the Study

The sample of the study was Grade IX students at a Government Girls High School, Patna, which consisted of 80 students; these 80 students were further divided into two equivalent groups of 40 each through one-to-one matching of the subject following Intelligence test (Nathan Haselbauer, 2005). One group was an experimental group, and the other was the control group. The students selected for the study belonged to the lower middle income class.

Tool Used

1. 5E instructional designs in social studies for the Grade IX students were developed by the investigators.

   Development of 5E instructional design: For the 5E instructional approach, investigators have adopted lesson design from the Social Studies textbook in Economics for Grade IX, NCERT. Two instructional designs had been prepared for experimentation from the chapter 'Poverty as Challenge' and 'Food Security in India'.

2. Achievement tests in Social Studies (ATSS): for Grade IX of pre-test and post-test, were developed and validated by the investigators.

   Selection of items for Achievement test in Social Studies (ATSS): Two sets of 50 questions were developed for both pre-test and post-test with the consultations of the experts and the research supervisors to assess achievement in Social Studies. Through pilot testing and item analysis, 35 items were selected for the final form of achievement test in Social Studies wherein, the major objectives were categorised as knowledge, understanding, and applications consisting of 12, 12, and 11 items respectively for both pre-test and post-test.

3. Interest Inventory in Social studies (IISS) for Grade IX of pre-test and post-test, were developed and validated by the investigators.

   Selection of the items for Interest Inventory in Social Studies (IISS): A set of 50 questions were developed with the consultations of the experts and the research supervisors to assess the student's interest in Social Studies. Through pilot testing and item analysis, 35 items were selected for the final form of interest inventory in Social Studies.

Reliability and Validity

Test reliability of ATSS was measured by Kuder-Richardson Formula-20 (KR-20). The reliability coefficient of the ATSS was found to be 0.6828 for the pre-test, the reliability coefficient to the ATSS was found to be 0.7010 for the post-test. The reliability coefficient of the interest inventory was found to be 0.52. The face validity of the achievement test and interest inventory were ascertained with the help of education experts

and their suggestions were carefully incorporated.

The Procedure of Experimentation for the Data Collection

Initially, both the experimental group and control group were administered with achievement and interest tests as pre-tests in Social Studies. The experimental group then learned two topics, i.e., Poverty and Food Security from their Social Studies syllabus through the 5E based instructional designs whereas the same topics were also taught to the control group simultaneously through the lecture method by the investigators. The investigators kept closed observation of the students during the treatment period. After two weeks, both the groups were again administered with post-tests on achievement as well as interest in Social Studies.

Analysis of Data

The data collected through the administration of the two tests were analysed through the application of the required statistical methods, i.e., mean, S.D. and t-test.

Hypotheses Testing

Ho 1. There is no significant effect of the 5E based instructional approach on achievement in social studies of Grade IX students.

For testing hypothesis, t-test has been done. The mean, standard deviation, and t-value of the gain score in achievement in social studies between the groups have been shown in the following Table 2.

Table 2
Mean, S.D., and T-Value of Gained Scores showing Achievement in social Studies of Grade IX Students in Learning through 5E Instructional Approach

Groups	N	M	SD	df	t
Experimental	40	7.15	2.15	78	8.489**
Control	40	3.37	1.80		

** t-value is significant at 0.01 level

Table 2 reveals that the number of students in experimental and control groups is 40 each. The mean of the experimental group is 7.15 and S.D. is 2.15. On the other hand, in the control group, the mean is 3.37 and S.D. is 1.80. The calculated t-value is significant at 0.01 level (Table value at 0.01 level is 2.37 for 78 df) so the null hypothesis is rejected. Hence, it is concluded that there is a significant effect of the 5E based instructional approach on achievement in social studies of Grade IX students, i.e., the experimental group has performed significantly better in social studies than the control group. This outcome can also be seen in Fig. 2.

Ho 2. There is no significant effect of the 5E based instructional approach

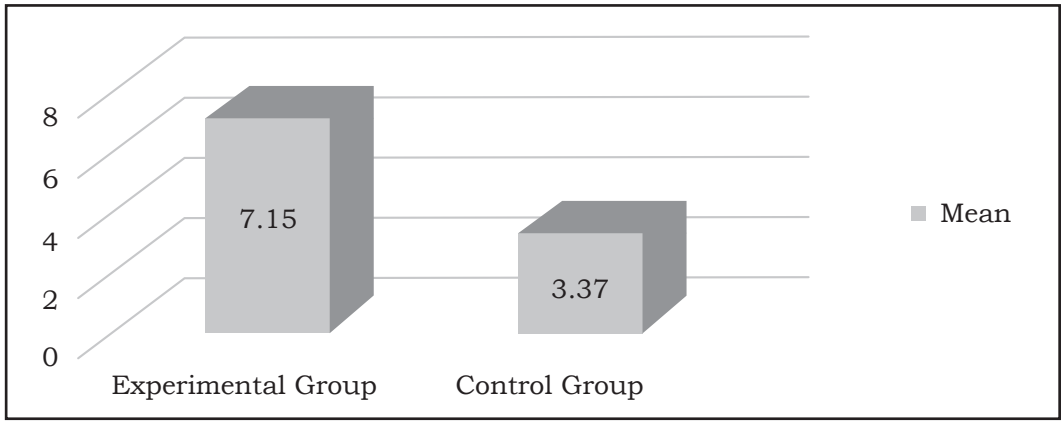

Fig. 2: Mean gain score comparison in achievement in social studies of an experimental group and control group

on interest in social studies of Grade IX students.

For testing hypothesis, t-test has been done. The mean, standard deviation, and t-value of the gained score representing interest in social studies between the groups have been shown in the following Table 3.

Table 3
Mean, S.D., and t Value of Gain Score in Interest in Social Studies of Grade IX Students in Learning Through 5E Instructional Approach

Groups	N	M	SD	df	t
Experimental	40	92.52	13.29	78	28.06**
Control	40	13.27	11.91		

***t-value is significant at 0.01 level*

It can be seen in Table 3, the number of students in the experimental and the control groups is 40 and 40, respectively. The mean of the experimental group is 92.52 and S.D. is 13.29. On the other hand, in the control group, the mean is 13.27 and S.D. is 11.91. The calculated t-value is significant at 0.01 level (Table value at 0.01 level is 2.37 for 78 df) so the null hypothesis is rejected. Hence, it is concluded that there is a significant effect of the 5E based instructional approach on interest in social studies of Grade IX students, i.e., the experimental group has performed significantly better in social studies than the control group. This outcome can also be seen in Fig. 3.

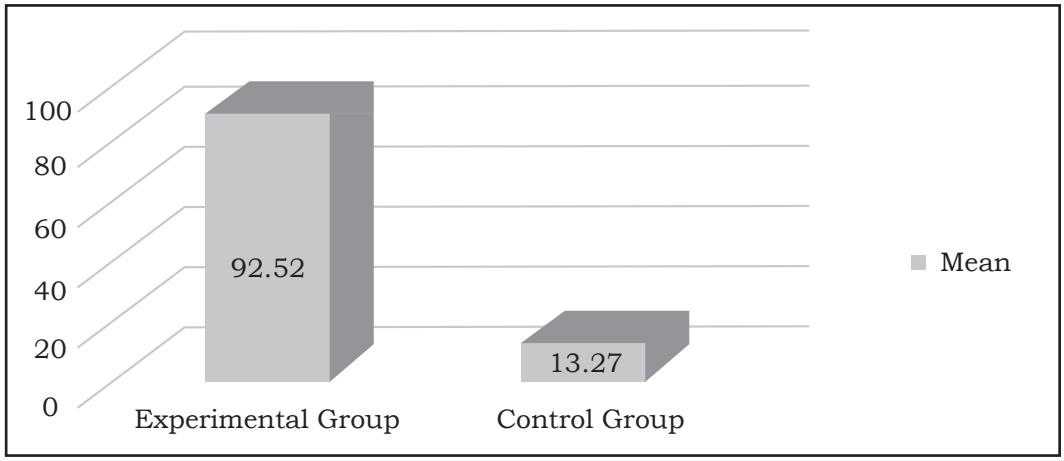

Fig. 3: Mean gain score comparison in interest in social studies of an experimental group and control group

Ho 3. There is no significant difference in the achievement in social studies between girls less than 14 and 14 and above years of age of Grade IX learning through a 5E based instructional approach.

For testing hypothesis t-test has been done. The mean, standard deviation, and t-value of the gain score in achievement in social studies between the groups have been shown in the following Table 4.

Table 4
Mean, S.D., and t Value of Gain Score in Achievement in Social Studies of Grade IX Students in Learning Through 5E Instructional Approach

Groups	N	M	SD	df	t
Girls less than 14 years of age	17	33.13	1.46	38	1.75*
Girls having age 14 and above	23	32.26	1.93		

**t-value is not significant at 0.05 level*

Table 4. shows that the number of girls less than 14 years of age and age 14 and above in the experimental group is 17 and 23 respectively. The mean of girls less than 14 years of age is 33.13 and S.D. is 1.46. On the other hand, the mean for the girls having the age 14 and above is 32.26 and S.D. is 1.93. Here the degree of freedom is 38 and t-value is 1.75. The tabulated value offered at 38 df is 2.02 which clearly shows that t-value is not significant at 0.05 level. So, the null hypothesis is accepted. Hence, there is no significant difference in the achievement in social studies between girls less than 14 and 14 and above years of age of Grade IX learning through a 5E based instructional approach. This outcome can also be seen in Fig. 4.

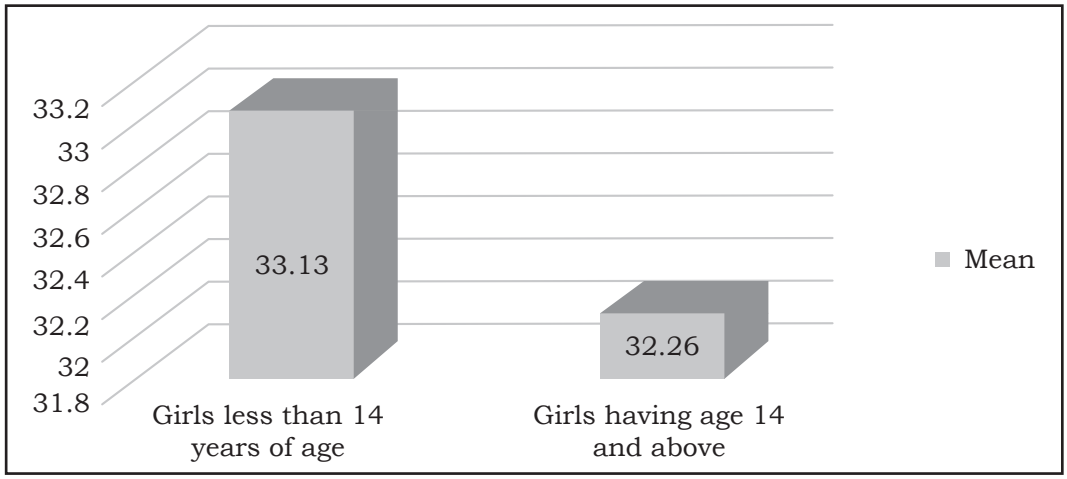

Fig. 4: Mean gain score comparison on achievement of girls less than 14 years of age and age 14 and above through 5E instructional approach

Ho 4. There is no significant difference in the interest in social studies between girls less than 14 and 14 and above years of age of Grade IX learning through a 5E based instructional approach.

For testing hypothesis, t-test has been done. The mean, standard deviation, and t-value of the gain score in interest in social studies between the groups have been shown in the following Table 5.

Table 5
Mean, S.D., and t-Value of Gain Score in Interest in Social Studies of Grade IX Students in Learning Through 5E Instructional Approach

Groups	N	M	SD	df	t
Girls less than 14 years of age	17	233.70	8.20	38	0.38*
Girls having age 14 and above	23	234.73	8.87		

**t-value is not significant at 0.05 level*

Table 5 depicts the number of girls less than 14 years of age and age 14 and above in the experimental group is 17 and 23 respectively. The mean of girls less than 14 years of age is 233.70 and S.D. is 8.20. On the other hand, the mean for the girls having the age 14 and above is 234.73 and S.D. is 8.87. Here the degree of freedom is 38 and t-value is 1.75. The tabulated value offered at 38 df is 2.02 which clearly shows that t-value is not significant at 0.05 level. So, the null hypothesis is accepted. Hence, there is no significant difference in the interest in social studies between girls less than 14 and 14 and above years of age of Grade IX learning through a 5E based instructional approach. This outcome can also be seen in Fig. 5.

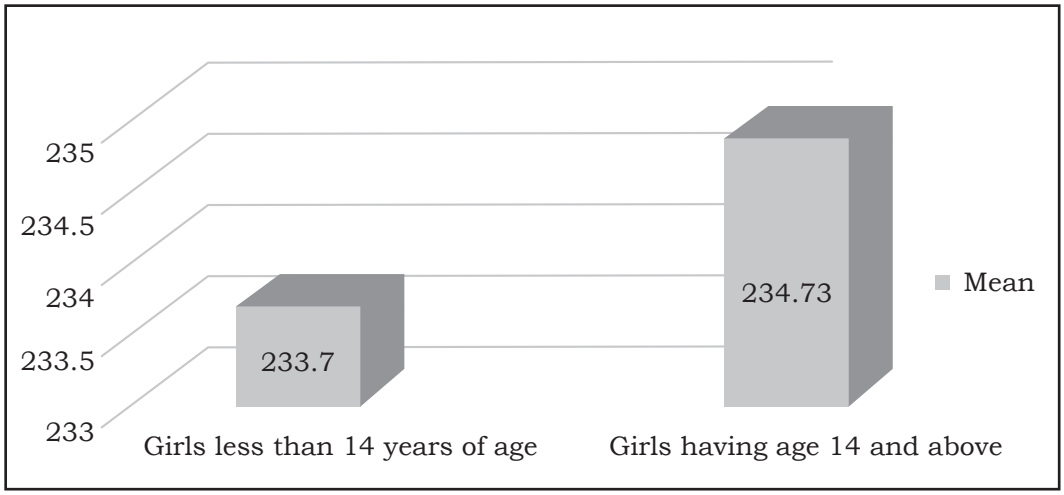

Fig. 5: Mean gain score comparison on interest of girls less than 14 years of age and age 14 and above through 5E instructional approach

Findings on Hypotheses

- There is a significant effect of the 5E based instructional approach on achievement in social studies of Grade IX students.
- There is a significant effect of the 5E based instructional approach on interest in social studies of Grade IX students.
- There is no significant difference in the achievement in social studies between girls less than 14 and 14 and above years of age of Grade IX learning through a 5E based instructional approach.
- There is no significant difference in the interest in social studies between girls less than 14 and 14 and above years of age of Grade IX learning through a 5E based instructional approach.

Discussion and Conclusion

In this study, there is a significant effect of the 5E based instructional approach on achievement and interest in social studies among Grade IX students. The study by Oteles, (2020) indicated that using the 5E learning model in teaching Social Studies affects the academic achievement of students positively, similarly in Mathematics by Ranjan and Padmanabhan (2018), Science by Fazelian, Ebhrahim, and Soraghi (2010), Andu (2021) which are in support of the findings. The 5E learning cycle with a cognitive technique consisting of intelligibility, plausibility, and wide applicability could develop efficiency in learning achievement, basic science process skills, and critical thinking of students.

The teachers, therefore, should be encouraged and motivated to implement this approach in teaching environmental education in all grade levels (Buntod, Suksringam, and Singseevo, 2010; Yadigaroglu and Demiricioglu, 2012). A similar study by Borah (2020) has shown that the five phases of the transactional model of knowledge of the 5E model are more interesting for the learners of Social Science than the conventional teaching approach. With reference to age, it is found that there is no significant difference in the achievement and interest in social studies between girls less than 14 and 14 and above years of age of Grade IX learning through a 5E based instructional approach. This may be due to learners' involvement and active participation irrespective of their age differences. At the same time, it can also be referred that the 5E model lessons can affect achievement and interest during the critical phase of learning. Therefore, it is essential to encourage social studies teachers to introduce and use active learning approaches grounded in research on constructivist learning models in their classes. The same emphasis is seen in the study by Iiter and Unal (2014), Chin and Kayalvizhi (2005) wherein the outcomes of the study proposed that 5E constructivist model applications by teachers increase students' motivation levels and change their feelings and thoughts towards the course.

Recommendations

From the outcomes of the study, the following suggestions are made for further research:

- Further research can be carried out to find out the effect of the 5E instructional approach in understanding and the achievement of students from schools situated in different contexts to have more accurate results based on this generalisation.
- Long term research studies with a 5E learning approach can be undertaken to analyse the effects of interventions on the prevalence of alternative conceptions.
- The 5E learning approach can be undertaken in a parallel mixed methods design of research, in which the data collected by means qualitative and quantitative methods can be discussed, integrated, and interpreted together to give comprehensive findings.

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