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Summary and Conclusions

In the preceding chapters, the introduction of the problem, development of the tools, method of study and interpretation of results were discussed. The present chapter presents a brief summary of the investigation and the conclusions of the study.

5.1 Introduction

Instruction is the arrangement of information and environment to facilitate learning. Environment is not just the place where instruction takes place, it is also including the methods, media, and equipments needed to convey information and guidance for learner’s study. Information and environment can be arranged in different ways. This arrangement is usually the responsibility of the instructor and the designer of media. The choice of the strategy of instruction determines the environment (the methods, media, equipment, and facilities) and how the information is assembled and used.

The method can range from teacher control to learner control. We must keep in mind that even with methods and media that encourage students to take control of learning, some guidance is inevitably built in. On the other hand, instructor control can be direct even though incorporated into media.

Matching the instruction to the aptitudes and abilities of learners (often, if not always) in order to academic achievement enhancement, has been a great challenge to educators, because research into new instructional
methods consistently indicates that certain treatments work for certain conditions. There are no panaceas. Other educational outcomes (specially creativity) have been rarely in the focus of investigation.

According to Robert Heinich and his colleges (1993), the great quest in the field of media and technologies of instruction is to find ways of matching learners with the appropriate subject matter, pitched at the right level, and presented in a compatible medium at the optimal pace in the most meaningful sequence. True individualization imposes a tremendous burden of decision-making and resource management. One instructor might approach an ideal level of individualization with a handful of students. But when dealing with 20, 30, 40, or more students, the logistics of individualization overwhelm any single teacher’s capacity. The computer gives promise of overcoming these and other logistical barriers to the individualization of instruction.

So the present study was conducted to find out the effectiveness of instruction through computers in terms of its contribution to the development of general and scientific creativity in relation to intelligence, attitude towards media and socio-economic status of students.

5.2 Statement of the problem

“Computer Application In Teaching Physics And Its Effect On General And Scientific Creativity In Relation To Intelligence, SES And Attitude Towards Media ”

5.3 Objectives of the study

The present study was designed to attain the following objectives:

• To select the segment of Physics for the experimental treatment and the package of software for teaching at the specified level.
• To study the effectiveness of the computer application as compared to conventional teaching regarding general creativity, its components and scientific creativity.

• To study the effects of intelligence, attitude, and SES on general creativity, its components and scientific creativity.

• To study the two order and higher order interactions among the factors under study.

5.4 Delimitation of the problem

The study delimited with respect to level, subject and the sample. Only a segment of Physics course of the high school syllabus was taken for the study. The study conducted in the high school classes of the schools (boy and girls) situated in the urban setting of Esfahan.

5.5 Hypotheses of the study

The study was designed to test the following hypotheses in respect of the each one of the subscales of general creativity (i.e., figural fluency, figural flexibility, figural originality, verbal fluency, verbal flexibility, verbal originality, total verbal creativity, and total verbal creativity), general creativity and scientific creativity:

Main effects

\( H_1 \) Computer-assisted instruction (CIA) and conventional teaching method (CTM) yield different mean scores on this scale of creativity.

\( H_2 \) High and low intelligent groups attain different level of mean scores on each scale of creativity.

\( H_3 \) High positive and low positive attitudes produce different level of mean scores on each scale of creativity.
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H₄ Upper and lower level SES groups attain different level of mean scores on each scale of creativity.

Two order interactions

H₅ The difference of the performance on each scale of creativity is affected by the interaction effect of teaching method and intelligence levels.

H₆ The difference of the performance on each scale of creativity, through CAI and CTM, is affected by levels of attitude.

H₇ The difference of the performance on each scale of creativity, through CAI and CTM, is affected by levels of S.E.

H₈ The performance scores on each scale of creativity attained by the two intelligence groups are affected by their attitude levels.

H₉ Intelligence and SES interact in respect of their performance on each scale of creativity.

H₁₀ Attitude and SES interact in respect of their performance on each scale of creativity.

Three order interactions

H₁₁ Variables treatment, intelligence, and attitude interact in respect of their performance on each scale of creativity.

H₁₂ Variables treatment, intelligence, and SES interact in respect of their performance on each scale of creativity.

H₁₃ Variables treatment, attitude, and SES interact in respect of their performance on each scale of creativity.

H₁₄ Variables intelligence, attitude, and SES interact in respect of their performance on each scale of creativity.

Four order interaction

H₁₅ Variables treatment, intelligence, attitude, and SES interact in respect of their performance on each scale of creativity.
5.6 Sample

For conducting the study, 10 schools from five educational districts of Esfahan were selected randomly. All the school had three or more sections of 30 students each where Physics was taught as a subject. The final sample comprised of 184 students. Half of them were selected from the 5 schools where computer facilities were available for teaching Physics through CAI. The selected students were matched with respect to intelligence, attitude towards media and socio-economic status. One group was allotted to computer assisted instructional system and the other to the conventional method of teaching.

5.7 Tools used

The following tools were used for data collection:

- Raven's progressive matrices (1962)
- Scale of attitude towards media developed by Deepa Sikand (1995)
- Socio economic status rating scale developed by the investigator
- Torrance Tests of creative thinking (1968)
- Tests (Part I and II) for measuring the scientific creativity. (Majumdar, 1982)

5.8 Design of the study

The study employed a 2x2x2x2 factorial design. The socio economic status, intelligence and attitude towards media were independent variables, whereas the general creativity (Figural and Verbal parts including Fluency, Flexibility and Originality subscales) and scientific creativity were the dependent variables. Each independent variable varied
at two levels. The treatment variable of the method of teaching also was varied at two levels: Computer assisted instruction (CAI) and lecture or conventional teaching method (CTM). The sample was divided into 2 groups, one was taught through CAI and the other through CTM. Analysis was done on the differences of pre and posttests scores of the criterion variable.

5.9 Procedure

After the selection of the sample and allocation of students to the instructional methods, the experiment was conducted in the following phases.

(I) Scores of 360 students on Ravens Advanced Progressive Matrices in each group were extracted from their files. The top 25 percent and bottom 25 percent students were selected to represent high and low intelligence subgroups.

(II) The scale of attitude towards instructional media was administered to both the subgroups. Then the filled up scales were scored. Thus, obtained scores of each student were arranged in order of magnitude. Then, high and low positive attitude subgroups were determined.

(III) Administration of the Socio-Economic Status scale.

(IV) Then the criterion tests were administered before the instructional treatment. The scores were used as pretest scores.

(V) Teaching through computer assisted instruction system and conventional method was done.

(VI) The criterion tests were administered again after the instructional treatment.

5.10 Statistical techniques used

The obtained data were presented through the graphs such as frequency polygons and bar diagrams. The means and standard deviations
were calculated for the data. The data were also analyzed with the help of a 4-way analysis of variance (ANOVA) to test the hypotheses related to method of teaching, intelligence, attitude towards media and socio-economic status.

5.11 Findings

The findings of the study have been presented as follows:

5.11.1 On figural fluency

*Treatment and attitudes* interaction affected the figural fluency. It is conceived that the performance scores on figural fluency increased with increasing positive attitude towards educational media, when the students taught with the help of computer.

5.11.2 On figural flexibility

The variation in *attitude* levels affected the figural flexibility, which means students with high positive attitude towards media, scored significantly higher on figural flexibility.

*Treatment, intelligence, attitude and SES* interacted with each other affecting the figural flexibility suggesting that:

A. In case of high intelligent students coming from lower SES strata, with increasing positive attitude, the conventional group surpassed the experimental group in effectiveness on figural flexibility.

B. The mean of figural flexibility scores of high intelligent students coming from upper SES strata increased with attitude when taught through CAI and decreased with the same when taught through conventional method.
C. The mean of figural flexibility scores of low intelligent students coming from lower SES strata increased with attitude more rapidly than the mean scores of control group of similar characteristics.

D. The mean of figural flexibility scores of low intelligent students of upper SES strata followed almost the similar trend with increasing positive attitude in case of experimental and control group.

5.11.3 On figural originality

Regarding figural originality, treatment, intelligence, attitude and SES interacted with each other suggesting that:

A. The means of figural originality scores, in case of high intelligent students of lower SES strata, increased with increasing positive attitude more rapidly through experimental treatment than through conventional teaching.

B. The means of figural originality scores, in case of high intelligent students of upper SES strata, showed a rapid increase with increasing positive attitude when exposed to experimental treatment and a rapid decrease with increasing positive attitude when exposed to conventional teaching.

C. In case of low intelligent students of lower SES strata, the means of figural originality increased with increasing positive attitude more rapidly for experimental treatment than for conventional teaching.

D. In case of low intelligent students of upper SES strata, the means of figural originality scores increased with increasing positive attitude more rapidly for conventional teaching than for experimental treatment.
5.11.4 On verbal fluency

*Intelligence, attitude and socio-economic status* interacted with each other affecting the verbal fluency suggesting that:

A. In case of high intelligent students of lower SES strata, the means of verbal fluency increased gradually and that of low intelligent students of the same SES strata decreased rapidly with increasing positive attitude.

B. In case of high intelligent students of upper SES strata, the means of verbal fluency decreased rapidly and that of low intelligent students of the same SES strata increased equally with increasing positive attitudes.

5.11.5 On verbal flexibility

No differences among all groups were observed.

5.11.6 On verbal originality

The *teaching method* affected the verbal originality, which means students who received instruction through CAI scored significantly higher on verbal originality.

*Treatment, intelligence, attitude and SES* interacted with each other affecting the verbal originality. The results lead to:

A. The means of verbal originality, in case of high intelligent students of lower SES strata showed a decrease when exposed to experimental treatment and a gradual increase when exposed to conventional teaching, both with increasing positive attitude.

B. The means of verbal originality in case of high intelligent students of upper SES strata, showed an increase with increasing positive attitude when exposed to experimental treatment and a rapid
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decrease with increasing positive attitude when exposed to conventional teaching.

C. The means of verbal originality, in case of low intelligent students of lower SES strata, showed a rapid increase with increasing positive attitude when exposed to experimental treatment and a rapid decrease with increasing positive attitude when exposed to conventional teaching.

D. The means of verbal originality, in case of low intelligent students of upper SES strata, showed a slow decreasing trend with increasing positive attitude when exposed to experimental treatment and a rapid increase from bottom to top with increasing positive attitude when exposed to conventional teaching.

5.11.7 On total figural creativity

Regarding total figural creativity, treatment and attitudes towards media interacted with each other. It was found that the performance scores on figural creativity increased with increasing positive attitude towards educational media, when students taught with the help of computer.

Regarding total figural creativity, treatment, intelligence, attitude and SES interacted with each other. It was found that:

A. For high intelligent group of lower SES strata with increasing positive attitude, the experimental group showed a very high order of increase in their figural creativity scores as compared to the control group,

B. For high intelligent group of upper SES strata, the increase in attitude levels corresponded with rapid increase of mean scores of figural creativity in case of experimental group and rapid decrease in case of control group.
C. For low intelligent group of lower SES strata, the increase in levels of attitude corresponded with rapid increase in figural creativity test scores in case of experimental group and no increase at all in case of control group.

D. For low intelligent students of upper SES strata, with rise in attitude scores, there was a more rise in figural creativity scores in case of control group than experimental group.

E. The interaction between treatment and attitude was almost similar in high and low intelligent groups of lower SES strata, but it was reversed in high and low intelligent of upper SES strata. High intelligent group is benefited more by experimental treatment and low intelligent group by conventional method with favorable attitudes.

5.11.8 **On total verbal creativity**

*Treatment, intelligence, attitude and socio-economic status* interacted with each other affecting the total verbal creativity. It was found that:

A. In case of high intelligent students coming from lower SES strata, the means of total verbal creativity increased with increasing levels of attitude almost in a parallel way for treatment and control groups.

B. In case of high intelligent students coming from upper SES strata, the means of total verbal creativity declined with increase in attitude scores both for treatment and conventional teaching group with a difference that decline was more rapid for conventional than for treatment.

C. In case of low intelligent students coming from lower SES strata, the means of total verbal creativity, decreased for conventional and increased for treatment group with increasing levels of attitude.
D. In case of low intelligent students coming from upper SES strata, the means of total verbal creativity did not much deviate for treatment group, but it increased rapidly from bottom to top for conventional group with increasing levels of attitude.

5.11.9 On general creativity

The experimental treatment affected the general creativity scores, revealing that students who received instruction by CAI, scored significantly higher on general creativity.

Treatment and attitudes towards media interacted with each other affecting the general creativity. It is conceived that the performance scores on general creativity are increased with increasing positive attitude towards educational media when students taught with the help of computer.

Treatment, intelligence, attitude and SES interacted with each other affecting the general creativity. It was observed that:

A. In case of high intelligent students coming from lower SES strata, the means of general creativity scores increased more rapidly for experimental group as compared to the control group with increasing attitude levels.

B. In case of high intelligent students coming from upper SES strata, the means of general creativity scores increased gradually for experimental group and decreased sharply from top to bottom for control group both with increasing attitude levels.

C. In case of low intelligent students coming from lower SES strata, the means of general creativity scores increased for experimental treatment and decreased for control group uniformly with increasing attitude scores.
D. In case of low intelligent students coming from upper SES strata, the means of general creativity scores did not change for experimental group, but increased markedly for control group with increasing levels of attitude.

5.11.10 On scientific creativity

Regarding scientific creativity, intelligence and SES interacted with each other. It was found that the performance scores on scientific creativity increased with increasing both the intelligence and SES levels.

Treatment, intelligence, attitude and SES interacted with each other affecting the scientific creativity.

A. In case of high intelligent students coming from lower SES strata, the mean of scientific creativity scores increased sharply for experimental group, but remained unchanged for control group with increasing levels of attitude.

B. In case of high intelligent students coming from upper SES strata, the mean of scientific creativity scores increased sharply for control group, but showed a slight decrease for experimental group with increasing levels of attitude.

C. In case of low intelligent students coming from lower SES strata, the means of scientific creativity increased in a parallel way for experimental as well as control group with increasing levels of attitude.

D. In case of low intelligent students coming from upper SES strata, the means of scientific creativity showed a slight increase for experimental group and rapid fall for control group with increase in attitude levels.
5.12 Educational implications of the findings

The findings of the study suggest that instruction with the help of computers may be used to develop the verbal originality and also general creativity ability among students studying Physics at the secondary level.

Since significant interactions were found between computer assisted instruction and attitude towards media affecting the figural fluency, total figural creativity and general creativity, it would be desirable to develop positive attitude towards instructional media by suitable use of media and also by holding free discussions on positive gains made by all teachers and learners from the application of media specially the computers.

The study provides evidence to the conclusion that the inclusion of data on student intelligence and socio-economic status in placement of decision may result in more effective use of CAI.

5.13 Suggestions for further study

- The study may be replicated in other subjects at secondary school level.
- The study may be conducted by involving other variables, whether organismic or environmental.
- Further studies can be designed to compare different methods or models of teaching through CAI.
- Further studies can be designed to find out that how CAI can be effective in other areas of educational outcomes.