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A Suggested Statistical Program to Enable Secondary Stage Students to Acquire Statistical Concepts and to Develop their Statistical Thinking Skills

(Summary)

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Summary

Introduction

It is becoming more widely recognized that in today's data-driven society, Statistics plays a key role in shaping policy in a democratic society, so statistical literacy is essential for all citizens in order to keep a democratic government strong, All students shouldn't leave high school without being engaged in the study of statistics. It is no longer adequate for high school students to take a sequence of courses designed only to prepare them for the study of calculus, exploring data, statistical reasoning, and statistical thinking are essential for all students, Recognizing the key role that statistics play in modern society, the National Council of Teachers of Mathematics (NCTM) recommended that "by the end of high school students should have a sound knowledge of elementary statistics", using calculators and computers to teach statistics .

The problem of the research

The problem of the research can be stated in the following:

There are a lot of deficiencies in teaching statistics in the secondary schools, the features of these deficiencies are the following:

1) Statistics is taught only as an optional subject to the third grade.
2) Teaching the statistical concepts without indicating their real live applications.
3) The teaching methods followed in teaching statistics (traditional lectures and discussions) in the secondary stage don't develop the different statistical thinking skills for the students.
4) We don't depend on the new technological techniques in the field of statistics as calculators and computers.

So, there is an argent need to answer the following questions:

1) What are statistical thinking skills that are suitable for the first secondary grade students?
2) What are statistical concepts and subjects that are suitable for the first secondary grade students?
3) What are the features of a suggested program in statistics for the first secondary grade students with the aim of:
    a) Acquiring students to the statistical concepts
    b) Developing the statistical thinking skills to the students.
    c) Developing the students' ability to use the computer and calculators statistically.
4) What are the effectiveness of the suggested program on:
    a) Acquiring the statistical concepts.
    b) Developing the statistical thinking skills of the students.
    c) Developing the students' ability to use the computer and calculators statistically.

The hypothesizes of the research

1) There is significant difference between means of pre-and post achievement test scores of experimental group.
2) There is significant difference between means of pre-and post statistical thinking test scores of experimental group.
3) There is significant difference between means of pre-and post computer test scores of experimental group.
4) There is effectiveness of the suggested program on:
    a. Acquiring the statistical concepts.

b. Developing the statistical thinking skills of the students.
c. Developing the students' ability to use the computer and calculators statistically.

The importance of the research

The importance of the research lies in the following

1) Developing teaching statistics in the secondary stage.
2) Helping teachers to:

a) help secondary stage students to acquire the statistical concepts
b) develop the statistical thinking skills of the secondary stage students
c) use suitable teaching aids to teach statistics
d) train students on using modern technological aids in the field of statistics

The aims of the research

The research aims at achieving the effectiveness of the suggested program in:

1) Helping the first-grade secondary stage students to acquire some statistical concepts and topics.
2) Developing the statistical thinking skills for the first-grade secondary stage students.
3) Developing the ability of the first-grade secondary stage students to use the modern technological aids in the field of statistics.

The limitations of the research

The research is limited by:

1) A sample of the first-grade secondary stage students in Fayoum governorate.
2) Some statistical concepts and topics in the level of the first-grade secondary stage students.
3) Some statistical thinking skills in the level of the first-grade secondary stage students.
4) Using calculators (Casio *fx-82TL*, Casio *fx-82MS*) and Microsoft Excel program.

The experimental design of the research

The experimental design of the research included only one experimental group. The following steps were followed:

1) Applying the preprogram – based tests on the sample of study.
2) Teaching the content of the suggested program to the sample of study using the suggested teaching strategy in the program.
3) Applying the post tests related to the program on the students the sample of the study.

The procedures of the research

To answer the first and the second questions of the research, the researcher has done the following:

1) Preparing a preliminary list of statistical thinking skills and another list of statistical concepts and topics to choose the suitable for the first-grade secondary stage students through:

a) making a survey of the previous educational literature and studies in the field of teaching statistics.

b) Reading the books of mathematics in the preparatory stage issued by the ministry of education, and the book of statistics of the secondary stage.
c) Reading some courses in statistics taught in some countries.
d) Reading the courses of computer taught at preparatory stage.
e) Reviewing the computer programs in teaching statistics.
f) Specifying the statistical processes that are conducted using calculators Casio *fx-82TL*, Casio *fx-82MS*

2) Showing the two lists to a group of jury members (experts in teaching mathematics, experts in mathematics and statistics , experts in psychology and supervisors of mathematics) with the aim of judging and applying the two lists.
3) Modifying the two lists in the light of the viewpoints of the jury and analyzing the results of Appling the two lists.

To answer the third question of the research, the researcher has Prepared a suggested program in statistics for the first grade secondary stage students to help them acquiring some statistical concepts and developing the skills of the statistical thinking according to the following steps:

1) Preparing the student's notebook according to the following steps:

a) specifying the aims of the program:
   - General aims
   - Behavioral objectives

b) Specifying the main and the subsidiary topics in each unit.
c) Choosing the educational experiences
d) Specifying the effective teaching strategy for the program.
e) Specifying the different techniques of evaluation.

2) Preparing teacher's guide to teach the program according to the suggested strategy:

The researcher prepared a teacher's guide to make use of in teaching. this guide indicates the ways of teaching the lessons of the program according to the suggested strategy. the guide includes the following:

a) Some brief information about statistical thinking.
b) The role of the teacher in teaching according to the strategy of (Think-Pair-Share) TPS strategy.
c) Teaching the lessons of the program according to the suggested strategy.
3) Showing the student's notebook and teacher's guide to the jury to specify the validity of the program to be applied.
4) Modifying the suggested program in the light of the views of the jury members.
5) Specifying the final form of the student's notebook and teacher's guide.
6) Specifying the methods of evaluation that includes:
    - An achievement test in the statistical concepts.
    - A test in the statistical thinking.
    - A test in using computer to represent data and to find some statistical measures.

Tests were prepared according to the following stages:

The first stage: planning and preparing tests through:

- Specifying the aims of each test.
- Reading the models of tests that were designed to measure statistical thinking.
- Reading TIMMS tests (Questions related to analyzing data and statistics).
- Reviewing the behavioral objectives of the program.
- Analyzing the content of the program.
- Specifying the kinds of the tests.
- Phrasing the items of each test.

- Preparing the answer sheet for each test.
- Phrasing the instructions of each test.
- Preparing the answer key for correcting each test.

The second stage: adjusting the tests through:

- Making use of the validity of the tests.
- Calculating the time and the reliability rate in each test.

In this way, the final version of the test was issued.

To answer the fourth question of the research, the researcher has done the following:

1) Selecting a random sample of first grade secondary stage students from the schools of Fayoum idara.
2) Applying the achievement, statistical thinking, and computer pretest.
3) Teaching the suggested program to the sample of the research.
4) Applying the achievement, statistical thinking , and computer post-test.
5) Writing down the results and manipulating them statistically.
6) Testing the hypotheses.
7) Explaining and analyzing the results
8) Presenting the recommendations and the suggestions.

The results of the research

The experimental manipulation of the results led to the following:

1) The reliability of the hypotheses, the statistical manipulation showed that there are some statistically significant differences between the mean scores of the pre and post application of the three tests supporting the post application in :

a) The acquisition of the students to the statistical concepts included in the program.
b) the development of the statistical thinking skills to the sample of the research.
c) Developing the ability of the students to use the computer to represent data and finding the statistical measures to the group of the data.

2) the program achieved high effectiveness in the acquisition of the students to the statistical concepts and in developing the statistical thinking skills, and developing the ability to use computer to represent data and finding the statistical measures to the group of the data.