A Suggested Science Curriculum for Hearing Impaired Primary Stage Students Based on Their Needs to Develop Their Preventive Awareness

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Abstract

The current research aimed at evaluating the effectiveness of a suggested science curriculum for hearing impaired primary stage students based on their needs to develop their preventive awareness. To achieve this aim, the researcher designed a list of the needs in whose light the suggested science curriculum for primary stage should be designed. This list was used to reach a suggested form for the curriculum to develop the dimensions of preventive awareness. A unit for sixth-year, primary stage titled 'the sun is the source of all energies' was selected and prepared in detail out of the suggested vision. In light of the previous, a teacher's guide to teach the unit was designed. In addition, the researcher prepared the research instruments which included an achievement test, an attitude scale, and a test for the ability to deal in real life situations. A group of participants was then selected to participate in the research and the instruments were applied to these participants before and after application. The results revealed that there is a statistically significant difference between the mean scores of the research participants in the pre and post-application of the achievement test, the attitude scale, and the test for the ability to deal in real life situations in favor of the post-application.

Keywords: A suggested science curriculum based on needs, hearing impaired students, primary stage, preventive awareness.

Research Questions and Delimitations

This research attempts to answer the following main question:

What is the suggested form of a science curriculum for hearing impaired primary stage students based on their needs to develop preventive awareness for these students?

The following sub-questions derive from the main question:

1. What are the needs in whose light the suggested science curriculum for hearing impaired primary stage students should be designed?
2. What is the form of the suggested science curriculum for hearing impaired primary stage students?
3. What is the effectiveness of teaching a unit of the suggested science curriculum in developing preventive awareness for hearing impaired students?

The research is delimited to the following:

1. A group of sixth-year, primary stage hearing impaired students (9 students) at Al Amal Deaf School, Al-Matariyyah Educational Administration, Cairo.
2. Applying the unit titled 'the sun is the source of all energies' out of the suggested curriculum's units during the first term, 2015-2016 on hearing impaired, sixth-year, primary stage students at Al Amal Deaf School due to the following reasons:
    1. Teaching this unit involves many experiments, visual teaching aids, and educational activities which can be effectively employed during teaching. Hence, learning occurs in a way that is effective and appropriate for the nature and characteristics of hearing impaired students. Furthermore, the desired educational aims are achieved.
    2. The unit's content includes sources of energy in our life such as the sun, electricity, and machines as well as the importance of keeping these sources, making good use of them, rationalizing their consumption, and consequently enhancing our life styles and our society.
    3. The information tackled by the hearing impaired student through this unit is related to scientific application in the form of advanced devices that he/she uses and experiences in everyday life and the

effect of these devices on human welfare and protecting the environment.

4. Measuring the effect of the unit on each of the preventive awareness aspects which are: the extent to which hearing impaired students can achieve the concepts and knowledge of the selected unit's scientific content at the levels of (knowledge, comprehension, and application); the hearing impaired students' attitudes towards the domains of preventive awareness (environmental, health, and technological); and the ability of hearing impaired students to deal in real life situations related to studying the selected unit in light of the domains of preventive awareness (environmental, health, and technological).
5. The research's results and their explanation are related to the nature of the participants, and the time and place of conducting the research.

Theoretical Background and Previous Studies

In light of the nature and objectives of the current research, the researcher presents the following:

First Axis: Hearing impaired students and educational strategies to communicate with them

a.Hearing Impairment: hearing impairment is considered a real problem that faces various societies whether advanced or developing. Hearing impairment, whether partial or total, prevents the child from participating positively and interactively in the environment where he/she lives. It also limits the child's willingness to practice different activities with peers. Hence, educating these students is important since it is the only way that increases their culture and ability to cope with the surrounding world. There have been various definitions of hearing impairment which tackled total impairment and partial impairment. Abdel Hamid (2011) defined the hearing impaired as: the person who suffers from a severe hearing loss which affects understanding of speech and the ability to continue

studying in normal schools with students at the same age whether or not using aural aids. This requires providing special programs which introduce educational services suitable for the nature of hearing impairment. Botros (2010) defined the hearing impaired as 'individuals who cannot use the sense of hearing in normal life purposes; whether the ones who were born completely deaf or with a degree of deafness that disabled them to depend on their hearing to understand speech and learn language, who turned deaf during their early childhood before they acquire speech and language, or who turned deaf directly after learning speech and language to the degree that the effects of this learning totally faded. In all cases, this results in losing the ability to speak and learn language.'

T. Abdel Raouf. and Abdel Raouf (2008) define the hearing impaired as 'the person who suffers from the loss of the hearing sense in a degree which prevents him/her from communicating with others except by using special methods and techniques which help him/her to communicate depending on the sense of sight.' Shukair (2005) believes that the hearing impaired person is 'a person who completely lost the sense of hearing before the age of five, which makes it difficult for him/her to achieve a response representing understanding of heard words and consequently cannot acquire language or communicate using regular methods. This could be due to genetic or acquired factors making the degree of hearing loss not lower than 70-75 decibels which prevents the hearing impaired person from enjoying life and making use of it and consequently he/she needs special techniques and methods to communicate, learn, and practice.' Al Wakfy (2004) mentions that the hearing impaired is 'the person whose hearing impairment disables him/her to successfully process linguistic information through the sense of hearing whether using aural aids or not. In addition, Al Zohairy (2003) indicates that the hearing impaired child is 'the child who lost the hearing ability before learning to speak or right after learning to speak to the extent that learning effects were lost quickly. This child suffers from a disability or a disorder that disables him/her to use the sense of hearing and therefore he/she cannot acquire

language in the regular way.' Moores (2001) states that deafness refers to 'the presence of a severe hearing impairment in the sense that the child finds it difficult to process linguistic information through the sense of hearing whether using aural aids or not and this affects the child's education negatively.'

Based on these definitions, the researcher reached an operational definition of the hearing impaired student who is 'the student who suffers from a severe hearing loss, 70 decibels and above, which has a negative effect on the student's acquisition of concepts and scientific facts in the regular ways like his/her normal peers. This requires the introduction of special curricula which suit the student's nature and needs.'

Communication methods for teaching the hearing impaired students: communication is the process of exchanging ideas and information among individuals. It is an active process which involves receiving, interpreting, and sending messages. Speech and language are basic means of communication. There are other methods which involve non-verbal communication such as gestures, position of the body, eye-contact, facial expressions, and head and body movements (Yahia, 2004). Hearing impaired education and social preparation requires training them on effective communication methods that are appropriate for their degrees of impairment with the purpose of enabling them to express their thoughts, feelings, and attitudes; to interact among themselves and with others; and to engage in social life. These methods are explained below:

Oral method: A method for communicating with the hearing impaired which is used in teaching and training hearing impaired children and providing them the linguistic skills that help them adapt with the world of normal children. It depends on the hearing impaired child's observation of the tongue and lips' movements and translating these movements into letters and words that he/she learns. This is sometimes called speech reading or visual reading since it depends completely on the sense of sight in realizing letters and words spoken by the

speaker's lips as well as realizing the speaker's facial expressions and movements (Shoair, 2009).

Manual method: It is used for developing the cognitive abilities of the hearing impaired child and it includes:

Sign language**:** which is a visual sensory system based on relating the sign to meaning. This language depends on signs performed by hands and facial expressions to indicate different topics. It is an independent language related to the environment where the hearing impaired lives. Sign language differs from one country to another and one city to another. In addition, most signs are imitations of what is present in nature or remarks of things through which the hearing impaired realizes the spoken language (Rochester institute of Technology, 2004; Yahia, 2004). There are two types of sign language:

Descriptive signs: which describe a particular object or idea and help to clarify the characteristics of something such as opening the arms to express multitude or reducing the distance between the thumb and the forefinger to express smallness or little amount. It should also be considered that both hearing impaired and normal students use these descriptive signs to clarify the meaning of words (Solaiman, 2001).

Non-descriptive signs: which are used only by the deaf. These are signs with special significance related to the language shared among the hearing impaired such as when the hearing impaired points down with his finger to mean that something is bad. Through this, the hearing impaired person gets images for words through signs (Roald, 2002).

Finger spelling: it is a type of communication methods used by the deaf students in which finger positions are used to represent alphabetical letters. These letters are used in turn to express words, phrases, and statements. This method is usually used when there are no signs expressing certain words, concepts, or different ideas (Botros, 2010).

Total Communication Method: This method depends on a philosophy which involves that there is no one best method for all deaf students at all times. In other words, there could be a good method to communicate with a deaf student but not necessarily the best way for another deaf student. Every student's nature and needs differ from those of other students and hence communication methods must vary and differ according to the nature of individual differences among deaf students (Al Shakhs & Al Tohamy, 2009). The results of the studies of Abdel Samiea (2007) and Abu Shama (2005) proved the effectiveness of teaching science for deaf students using the total communication method in increasing their cognitive achievement.

The nature of science curriculum for hearing impaired students: Ebid (2001) defined curriculum as 'the contents which the teacher teaches students.'

A group of bases to be considered when designing curricula for hearing impaired students were specified, these are:

- *Scientific basis:* we cannot educate and teach the hearing impaired students except if we make the courses and teaching methods, to be followed, suitable for the general characteristics, biological and psychological traits, and social circumstances of these students.
- *Social basis:* this represents the society and all its components including the cultural heritage, the traditions, and the social standards in addition to the society's problems, aims, and future and present hopes.
- *Educational and philosophical bases:* these bases have a great effect on designing courses for the hearing impaired. The evidence lies in that courses may differ according to the difference of the aims we seek to achieve. Educational and philosophical bases represent the philosophical and educational system; the educators' performance concerning the aims of education; and the school with its

role as an educational association seeking to achieve the aims based on a certain educational, social, and human philosophy adopted by the educational system.

- *Psychological bases:* these are related to studying the psychological and educational characteristics of the hearing impaired students; growth patterns and features for these students; their needs, inclinations, attitudes and their relation to educational courses; as well as the effect of learning and training theories regarding teaching methods especially because these theories are one of the means of specifying the courses' aims.

Second Axis: Preventive awareness

Education and instruction give special attention to awareness since this aspect of learning aspects, or what is called learning process outcomes, concerns the cognitive and affective aspects together. Awareness provides knowledge as well as making a valuable change in the individual's cognitive processes and this results in realization, understanding, analysis, and conclusion which extend to the individual's emotional structure (Al Laqany & Hasan, 1999). The importance of awareness lies in that it is included within the first level of the affective objectives' levels which describe the individual's inner emotions; these emotions are the basic drives of human behavior (Hasanien, 2008).

Although the cognitive aspect of preventive awareness is a first step in the framework of providing students with desired positive attitudes and behaviors, providing students with information and scientific concepts is not adequate for achieving this purpose. Over emphasis of the cognitive aspects away from affective and psychomotor aspects may not contribute in achieving preventive awareness, however, it may cause completely negative effects (Moussa, 2009). The process of developing and increasing awareness is considered a cultural issue which contributes in forming the society's mentality scientifically and makes the follow up of science and its achievements a part of the society's interests. Hence, the society

realizes the role of science and technology in solving its problems in a better way. There are several types of awareness which are developed for students in general through science teaching.

This research seeks to develop preventive awareness for hearing impaired primary stage students through the suggested science curriculum. Hence, it is important to shed light on the definition of preventive awareness, its domains, and the role of the suggested science curriculum in developing preventive awareness.

Definition of Preventive Awareness: Awareness is the first step in forming the affective aspects and the attitudes and values they include. Although awareness is classified as the lowest degree of the affective classification, it greatly involves the cognitive aspect. It refers to the individual's realization of particular aspects of a situation or a phenomenon and it involves several domains (Shehata & Al Najjar, 2011). In addition, awareness is a strong emotional affective load enabled through several behavioral phenomena for the individual. Awareness is developed through the stages of education and the more adult and fixed it is, the more likely it is to support and direct rational behavior in the desired direction (Ibrahim, 2009). It is also defined by D. Motawea (1999) as 'the information, knowledge, concepts, and beliefs that the students have and which affect their responses, behaviors, and roles towards a particular problem.' Out of the previous, it can be concluded that awareness includes three aspects:

The cognitive aspect: this is represented in the availability of scientific information about a particular phenomenon or topic.

The affective aspect: this is represented in forming inclinations and positive attitudes towards the topic. If the topic is 'environment' for instance, the individual should attempt to protect and keep it.

The applied (performative) aspect: this is represented in the individual's response to situations and phenomena correctly and rapidly and the ability to deal in life situations facing him/her.

It can be concluded that all the definitions of awareness agreed that awareness is achieved only with the combination of the cognitive, the affective, and applied aspects. The researcher defines preventive awareness as 'the individual's quick response resulting from being emotionally influenced by information and knowledge (environmental, health, and technological) about a situation or a real scientific problem. This response may appear in the form of behavior or a person's ability to make a decision towards the situation or the problem. Awareness is achieved only with the combination of the cognitive, the affective, and applied aspects and it includes several domains.'

Domains of Preventive Awareness: there are several domains of preventive awareness including:

- *Environmental awareness:* Science teaching provides multiple opportunities to develop environmental preventive awareness which is one of the aims of environmental education. Primary stage students are the basis of environmental education which is expected to achieve a great effect at this stage (Mutisya & Barker, 2011). Environmental preventive awareness helps the individuals achieve commitment based on sense and conscious awareness of the various environmental relations and problems. It also helps them to acquire patterns of behavior which represent a sense of responsibility towards the environment where they live in the sense that they care about maintaining and keeping their environment (Al Sherbiny & Al Tanawy, 2010). There are several definitions for environmental awareness: Hadzigeorgious and Skamiaus (2013) define environmental awareness as 'knowledge of the mutual relations or environmental issues and human life in a sense that knowledge affects the individual's life, how he/she feels, thinks, and acts. It is considered a basic

condition of environmental culture.' Awareness of the environmental risks is considered a vital part of the environmental awareness. It was defined by Samaan and Faraag (2002) as 'the realization of an individual centered around knowledge and feeling of environmental danger and his/her ability to specify the source and reason for that danger and avoiding this reason in everyday life situations'. Science curricula in general have multiple potentials to provide for students either the hearing impaired or the normal students within the area of protecting themselves first and then protecting the environment against the dangers threatening them. And hence these curricula carry the greatest load to achieve this. The study of N. Esmaeil (2008) tackled the designing of a program for scientific activities to develop awareness of the environmental risks and the results showed the program's effectiveness. The researcher benefited from the previous studies and literature in the field of environmental awareness and awareness of the environmental risks in specifying some of the environmental risks associated with environmental problems that are faced by hearing impaired primary stage students to develop their awareness of these problems.

- *Health awareness:* Mohamed (2014) defines preventive health awareness as 'raising the students' awareness towards the damages resulting from exposure to different materials used in the current period related to the revolution and what the students should do to avoid these damages.' It is also defined by Ibrahim (2009) as the individual's practice of sound health habits. One of the studies which tackled preventive health awareness is the study of Reda (2013) which aimed at developing health awareness as well as some 21st century skills for first preparatory level at Jazan University. The results of the study indicated the effectiveness of using social software in developing health awareness and some 21st century skills. In addition, the study of Al Sayed (2007) aimed at

developing awareness of incorrect health behaviors for primary stage students by using caricatures. The results indicated that there is a positive correlation between the prevalence of incorrect health behaviors and the degree of awareness of these behaviors for hearing impaired primary stage students.

Technological awareness: Due to the technological advancement in all the fields of life, science teaching should cope with this information and technological revolution and should provide the students a technological education for which technological awareness is a pillar (Al Nagdy, 1999). There is no doubt that science curricula can have a great role in creating and forming technological awareness for the students if they include different information about technology and its applications in society (Nagla, 1995). It has also become an aim of science teaching to develop a new awareness to understand the relation among science, technology, and society (S.T.S) since there is no aspect in our lives which is not affected by science, technology, or both (Shetewy, 2005). Technological awareness is defined as 'the students' realization of the extent to which technological development is involved in all the various aspects of their lives whether personal, educational, environmental, economic, cultural, or political aspects' (Al Mehy & Nagla, 2005). one of the studies which tackled technological awareness through science teaching is the study of Lotfy (2010) which aimed at developing awareness of the technological scientific issues which have an environmental social feature through a suggested program. The study concluded that the suggested program developed the aspects of awareness (cognitive, psychomotor, and affective). The study of Shetewy (2005) aimed at developing science curricula at the primary stage in light of the integration among science, technology, and the society. The study proved the effectiveness of a unit of the curriculum in developing achievement; the attitude towards the issues of science, technology, and the society; and the ability to deal in real life situations. It can be concluded that the tight relation among science, technology, and the society should be included within

science curricula at the different stages of education in general and for the hearing impaired students in particular so that hearing impaired students would have the opportunity to recognize the effective role played by science for human welfare and solving several problems and social issues resulting from scientific and technological advancement. This is achieved through selecting the topics to be included in the suggested science curriculum in light of their value and their relation to the students' lives and society. Science should not be learned without awareness of its application and without clarifying its relation with the hearing impaired students' lives. Based on the previous discussions, the researcher believes that preventive awareness includes multiple domains. These domains are not separate or isolated, but they are related and integrated.

The Role of the Suggested Science Curriculum in Developing Preventive Awareness: The role of scientific education has increased in light of the contemporary developments which reflect the features of the age of science and technology. Humans benefited from scientific and technological achievements and their positive aspects; however, they also have negative aspects. Together with these achievements, some problems and crises which threaten man and the environment have increased due to the unawareness of the right behavior towards them. These problems include environmental pollution with all its aspects and dimensions, energy crisis, etc. (Abdel Salam, 2001). Shoair (2005) also indicates the role of science in providing the students with the concepts and skills that help them in protecting themselves against exposure to some problems. This is due to the nature of science as the most related subject to the student's life and the health problems he/she faces. While preventive awareness represents an importance for ordinary students, its importance increases greatly for hearing impaired students due to two reasons. The first reason is that the percentage of disabled individuals in the society is not small, and as for the deaf, their number exceeds 70 millions. The second reason goes back to the negative effects caused by hearing impairment on the deaf person. It affects the cognitive, social,

emotional, educational, and health aspects. This affects in turn the deaf person's ability to learn and communicate with others and hinders the acquisition of information and experiences which help the deaf to protect themselves against the dangers that would face them. Hence, it was necessary to design a science curriculum for the hearing impaired students based on their needs to develop preventive awareness in order to keep their safety and health against accidents or expected dangers. The program also aims at developing their awareness of how to deal in a scientific organized way with the problems that may face them such as air pollution, lack of energy, electromagnetic pollution, dangers arising from over-exposure to the sun and sitting in front of the TV or computer for a long period, as well as dangers resulting from fuels.

Research Problem and Objectives

The researcher concluded the research problem through the following:

Reviewing the results of researches and previous studies which tackled:

1. *Designing special science curricula for hearing impaired students:* a few studies, such as the studies of Abdel Samiea (2007), Abdel Wahab (2000), and Fahmy (1989) indicated that there is a crucial need to prepare special curricula for hearing impaired students which consider the needs, characteristics, and abilities of these students. Looking at the reality of teaching science to hearing impaired students, we find that it depends on memorization without the students' positive and effective participation in the educational process. In addition, there is a weakness in using the teaching aids needed for achieving the aims of science teaching to the hearing impaired students. Furthermore, there is a concern with the students' memorization of the final information without caring about details which affects negatively on their academic achievement and their confidence in their ability to learn (Bahgaat, 2004).

2. *Developing preventive awareness:* there are various previous studies which tackled developing the domains of preventive awareness in general including the studies of A. Ahmed (2008), Abdel Rahman (2005), A. Motawea (2006), H. Abdel Fatah (2004), Khalil (2010), Mohamed (2014), and Radwan (2005).

The pilot study:

The researcher conducted a pilot study to identify the reality of science teaching for hearing impaired students at the primary stage. The study included:

1. *Interviews:* The researcher held open interviews with 10 teachers at Al Amal Deaf School (Al-Matariyyah Educational Administration) and Al Amal Deaf School at Abbasya as well as with 10 supervisors of special education in Cairo with the aim of identifying the viewpoints of science teachers and supervisors of special education about the degree of appropriateness of the current science curriculum in light of the nature of hearing impairment and the growth demands of hearing impaired students at the primary stage for developing preventive awareness domains.

The following results were concluded out of the interviews:

1. Most of the teachers and supervisors emphasized that hearing impaired students at the primary stage study the same content that is studied by normal students at the same stage with a slight simplification for lessons.
2. The content of the science curriculum is unrealistic, unsuitable for those students and it needs modification and reorganization. Hence, it is necessary to design science curricula which suit the needs of those students.
3. There is no science lab equipped with laboratory sets and tools which help teachers to implement the applied part of science. The teachers create some simple teaching aids at their own expense.

4. The teacher faces a difficulty to acquire the special signs related to the scientific concepts within the content because there is no sign dictionary for the scientific concepts. Consequently, each teacher depends on his/her own experience to present a descriptive sign for the concept which he/she may acquire from the hearing impaired students in class.
5. There is an agreement between teachers and supervisors that the current curriculum does not consider the individual differences among students and does not suit their needs and willingness to learn. Most of them also emphasized that it is necessary to design a science curriculum that achieves the aims of primary schools for hearing impaired students which contributes effectively to developing preventive awareness for these students.

These results agree with the results concluded by Abdou (1998), Abu Nagy (2003), Abu Shama (2005), Akl (2012), Al Laqanny and Hassan (1999), Al Qority (2001), Al Tohamy (2005), Berman, Guthmann, Crespi, and Liu (2011), Cahn (2006), Fahmy (1989), Hadzigeorgious and Skamiaus (2013), and Mathews (2007), Taha (2008), and Zidan (2003) that school books specialized for the hearing impaired students are not valid since the courses studied by these students are the same courses studies by normal students at the primary and preparatory stages.

It can be concluded that the research problem is specified in the lack of a science curriculum for hearing impaired primary stage students that is appropriate for their abilities and that considers their characteristics and needs.

The current research aims at:

1. Preparing a list of the needs in whose light the suggested science curriculum for the hearing impaired primary stage students should be designed.

2. Presenting a suggested form of the science curriculum for hearing impaired primary stage students based on their needs.
3. Applying one unit on a group of students to specify the extent to which preventive awareness developed in all aspects (cognitive, psychomotor, and affective) for hearing impaired students after studying the selected unit.

Research Procedures

To answer the research questions, the following procedures were followed:

First: to answer the first question, 'what are the needs in whose light the suggested science curriculum for hearing impaired primary stage students should be designed?', the researcher prepared a list of the needs that should be used in order to design the science curriculum for hearing impaired students. This was achieved through reviewing literature and previous studies which concerned designing science curricula and educational units for hearing impaired students whether in the primary, preparatory, or technical secondary stages, as well as investigating the international projects in developing science curricula for hearing impaired students. The initial form of the list was submitted to specialists in curriculum and instruction, mental health, special education, educational psychology, as well as supervisors of special education at the educational directorate in Cairo with the aim of identifying the extent to which the list was suitable for hearing impaired primary stage students and suggesting further needs. The list was modified according to their instructions, observations, and suggestions and some secondary needs were omitted. The final form of the list included (5) basic needs and (61) secondary needs.

Second: to answer the second question, 'what is the form of the suggested science curriculum for hearing impaired primary stage students?', the researcher specified the general aims of the suggested curriculum – in light of the list of needs previously

prepared, the general aims for hearing impaired education, and science teaching aims that suit the nature of hearing impairment – submitted them to jury members, and modified them according to their suggestions. The final form of the aims is clarified below:

1. Providing hearing impaired students an amount of information and scientific concepts to enable them to understand the environment where they live.
2. Drawing the attention of hearing impaired students towards observation of phenomena and different things, realizing the relation among them and the reasons behind them, and tasting the world's magnificence and beauty.
3. Providing hearing impaired students some technological aspects of devices as appropriate for their age realization in order to cope with the contemporary developments and challenges.
4. Developing awareness of the importance of following the appropriate health behaviors to avoid diseases.
5. Developing the skills of communicating with the surrounding environment through writing, reading, sign language, lips' reading, and reading tables and images.
6. Developing positive attitudes towards science and appreciating scientists in general and Arab scientists in particular.
7. Developing the students' awareness of environmental problems and suggesting solutions for them.
8. Providing the hearing impaired students the skills of group work and cooperation through their team work while achieving different activities.
9. Training the hearing impaired students on performing simple scientific experiments, while taking safety and security precautions, and developing their abilities to observe and conclude.
10. Enhancing the hearing impaired students' abilities to solve simple problems using creative methods.

11. Forming scientific attitudes for the hearing impaired student through guiding his/her behavior in everyday life situations.
12. Providing the hearing impaired student aesthetic values and sense of beauty through studying different topics.

The researcher prepared a general suggested form for the science curriculum and for the time necessary for teaching the curriculum's units.

Third: to answer the third question, 'what is the effectiveness of teaching a unit of the suggested science curriculum in developing preventive awareness for hearing impaired primary stage students?', the researcher followed the steps below:

Preparing and controlling the experimental unit: to verify the effectiveness of the suggested curriculum in developing preventive awareness for hearing impaired students, a unit of the suggested curriculum's units titled 'the sun is the source of all energies' was designed for six-year primary stage students to experiment it according to the following steps:

Reasons for selecting the experimental unit

The unit 'the sun is the source of all energies' was selected out of the suggested curriculum of the first term since its topic is related to the hearing impaired student's environment. It tackles sources of energy (the sun – electricity – machines) and how to keep them and make good use of them within the environment which made studying this unit functional, strongly related to the hearing impaired student's life, and far from the abstract look towards teaching facts and scientific concepts. In addition, the unit tackles the main source of energy; the sun and how to make use of it especially because the hearing impaired student seeks to adapt with the environment according to his/her needs and demands.

Preparing the experimental unit

In light of the unit's aims and the suggested science curriculum's contents, the basic topics of the unit were specified:

the sun, electricity, and machines. The unit's contents were specified, formed, and organized so that each topic was represented through some sub-lessons as appropriate for the characteristics and nature of six-year primary stage hearing impaired students. After the researcher specified the unit and its contents, she prepared a teacher's guide which included: the unit's title, learning aspects included within the unit, the unit's objectives, the teaching strategy used for teaching the unit, the activities and teaching aids, the lesson plans, and assessment.

Research Instruments: they include:

1. *Designing and statistically controlling the achievement test:* The achievement test was designed according to the following steps:

Specifying the test objectives, forming the test items, test validity, and piloting the test on a group of 9 sixth-year primary stage students at Al Amal Deaf School – Al-Matariyyah during the last week of September, 2015 – 2016.

Final form of the test

After modification, the items of the test were 30. One mark was given to each item the student answered correctly, and a zero was given in case of incorrect answers. Hence, the test's maximum score was (30) marks and minimum score was (0) marks. Table (1) clarifies the distribution of the achievement test's items on the preventive awareness dimensions at the three cognitive levels (knowledge – comprehension – application).

Table 1 Criteria of the achievement test in its final form

Item	Topics	Cognitive levels			Total	Percentage
		Knowledge	Comprehension	Application		
1	The sun	2,4,7	10,15,16,19	20,27,29	10	33 %
2	Electricity	3	8,12,14	5,18,20,24	8	26.6 %
3	Machines	1,6,9	11,13,17	21,23,25,26	12	40 %
Total		7	10	13	30	

2. *Designing the attitude scale:* After necessary modifications, the items of the scale were (30) items in its final form. A positive item on the three response (agree – undecided – disagree) Likert-type scale was given the

marks (1, 2, 3) respectively and vice versa as for negative items. Consequently, the maximum score for the scale was (90) marks.

Table 2 Dimensions of the scale and the statements measuring each dimension

Dimensions of the scale	Statement number for each dimension	Sum of statements	Percentage
1. Environmental attitudes	1, 4, 8, 11, 12, 13, 19, 22, 27, 29	10	33 %
2. Health attitudes	3, 5, 6, 7, 15, 16, 17, 20, 23, 24	10	33 %
3. Technological attitudes	2, 9, 10, 14, 18, 21, 25, 27, 28, 30	10	33 %

3. *Designing the test for the ability to deal in real life situations:* After modification, the final form of the test included (30) items. One mark was given for each situation in which the student dealt correctly, and a zero in case of selecting a wrong choice regarding the situation. Hence, the maximum test score was (30) and the minimum score was (0). The following table clarifies the criteria of the test for the ability to deal in real life situations with regard to preventive awareness dimensions:

Table 3 The criteria of the test for the ability to deal in real life situations with regard to preventive awareness dimensions

Dimensions	Item number	Sum of items	Percentage
1. Environmental awareness	1, 7, 4, 10, 13, 16, 19, 22, 25, 28	10	33 %
2. Health awareness	2, 5, 8, 11, 14, 17, 20, 23, 26, 29	10	33 %
3. Technological awareness	3, 6, 9, 12, 15, 18, 21, 24, 27, 30	10	33 %
Total number of situations		30	

Research group:

A group of students at Al Amal Deaf School, Al-Matariyyah Educational Administration, Cairo was selected to participate in the research due to the interest revealed by the school

administrators to help the researcher as well as the agreement of the general administration of special education to conduct the research at this school. The group included 9 male and female students who represent sixth-year, primary stage as a whole at the school, and who are all hearing impaired.

Experimentation Procedures

Pre-application of the research instruments

The researcher – with the help of the school teacher who is specialized in teaching hearing impaired students using communication techniques (sign language, lips reading, and total communication) – applied the research instruments (the achievement test, the attitude scale, and the test for the ability to deal in real life situations associated with the selected unit 'the sun is the source of all energies') before teaching the selected unit on the research group on Sunday, 28/9/2015. During application, the researcher explained the research instruments and their aims to students.

Administration of the suggested unit

There weeks before conducting the research experiment, the researcher met the science teacher at Al Amal Deaf School, Al-Matariyyah Educational Administration. During this meeting, the researcher clarified the purpose of the study and provided the teacher with a copy of the teacher's guide, a book, and a CD including the PowerPoint presentations and the educational videos. The researcher asked the teacher to read the guide carefully and record her inquiries during a whole week after which another meeting was held to discuss and clarify all inquiries. The researcher also made sure that all the instruments and educational materials necessary for implementing the lesson plans within the guide were available, especially different types of illustration cards and the materials and instruments necessary for experimentation activities. It was also checked that enough work sheets were available. The teacher started teaching the unit 'the sun is the source of all energies' during the first term 2015 –

2016 / three classes per week with a continuous follow-up on the part of the researcher.

Post-application of the research instruments

After teaching the unit's topics, the research instruments (the achievement test, the attitude scale, and the test for the ability to deal in real life situations related to preventive awareness) were applied starting from 16/11/2015 to 18/11/2015.

Results and Discussion

The most important results reached by the research are presented below in order to answer the research questions and verify the hypotheses:

First: Results of applying the achievement test: the first research hypothesis reads 'there is a statistically significant difference between the students' mean scores in the achievement test's application before and after studying the suggested unit in favor of the post-application.'

Table 4 Z value for the significance of differences between the means of the ranks of the research group's scores in the pre and post-application of the achievement test

Achievement test	Number	Mean of the negative ranks	Mean of the positive ranks	Total of the negative ranks	Total of the positive ranks	Z value	Significance
	9	0	5	0	45	2.690	0.007

Table 4 indicates that there is a statistically significant difference at the 0.01 between the means of ranks related to pre and post-application of the achievement test in favor of the post application.

To evaluate the effect size of the unit, 'the sun is the source of all energies' on six-year, primary stage hearing impaired students' cognitive achievement, the effect size of the Wilcoxon test was calculated through the following correlation:

$R\frac{z}{\sqrt{N}}$; N is the total number of observations of the research group

Table 5 Effect size (r)

Large	Medium	Small	Abs®
0.5	0.3	0.1	

R value, calculated through the previous correlation, equaled 0.629. This is the ratio of what is explained by the independent variable (the educational unit) out of the total variance of the dependent variable (the cognitive achievement); this ratio represents a large effect size and hence the first hypothesis was accepted.

Second: Results of applying the attitude scale: the second research hypothesis reads 'there is a statistically significant difference between the students mean scores in the scale of attitudes towards preventive awareness before and after studying the suggested unit in favor of the post-application'.

Table 6 Z value for the significance of differences between the means of the ranks of the research group's scores in the pre and post-application of the attitude scale

Attitude scale	Number	Mean of the negative ranks	Mean of the positive ranks	Total of the negative ranks	Total of the positive ranks	Z value	Significance
	9	0	5	0	45	-2.66	80.00

Table 6 indicates that z value equals -2.66 at the 0.01 level and hence the second hypothesis was verified, i.e. there are statistically significant differences between the means of the ranks regarding the pre and post-applications in favor of the post-application of the attitude scale. To evaluate the effect size of the unit, 'the sun is the source of all energies' on the attitude towards preventive awareness, the researcher calculated the effect size (r). R value, calculated through the previous correlation, equaled 0.64. This is the ratio of what is explained by the independent variable (the educational unit) out of the total variance of the dependent variable (the attitude towards

preventive awareness); this ratio represents a large effect size and hence the second hypothesis was accepted.

Third: Results of applying the test for the ability to deal in real life situations related to preventive awareness: the third research hypothesis reads 'there is a statistically significant difference between the students mean scores in the test for the ability to deal in real life situations before and after studying the suggested unit in favor of the post-application'.

Table 7 Z value for the significance of differences between the means of the ranks of the research group's scores in the pre and post-application of the test for the ability to deal in real life situations

Test for the ability to deal in real life situations	Number	Mean of the negative ranks	Mean of the positive ranks	Total of the negative ranks	Total of the positive ranks	Z value	Significance
	9	0	5	0	45	- 2.67	80.00

Table 7 indicates that z value equals -2.67 at the 0.01 level and hence the third hypothesis was verified, i.e. there are statistically significant differences between the means of the ranks regarding the pre and post-applications in favor of the post application of the test for the ability to deal in real life situations. To evaluate the effect size of the unit, 'the sun is the source of all energies', the researcher calculated the effect size (r). R value, calculated through the previous correlation, equaled 0.63. This is the ratio of what is explained by the independent variable (the educational unit) out of the total variance of the dependent variable (the ability to deal in real life situations); this ratio represents a large effect size.

Discussing and Interpreting Results

After presenting the results of the study, the following conclusions were reached:

1. There is a clear increase in the research group students' mean scores in the achievement test as a whole and in all its sub-levels (knowledge, comprehension, and application) in the post-application which emphasizes the effectiveness of the suggested unit in increasing achievement. It is also noticed that the effect size is large, which indicates that the suggested unit 'the sun is the source of all energies' was effective in increasing the achievement for the research group. These results agree with those of several studies which tackled the cognitive achievement of hearing impaired students in science through designing curricula or academic units appropriate for the nature of hearing impaired students or considered developing the cognitive achievement through using different teaching strategies such as the studies of Abdel Ghany (2005), Abdel Malek (2010), Abdel Wahab (2000), Akl (2012), Fahmy (1989), H. Ahmed (2009), M. Esmaeil (2014), Mohamady (2007), and R. Abdel Fatah (1992),.
2. There is a clear increase in the research group students' mean scores in the attitude scale as a whole and in all its sub-dimensions (environmental, health, and technological awareness) in the post-application which emphasizes the effectiveness of the suggested unit in developing the attitude towards preventive awareness. It is also noticed that the effect size is large, which indicates that the suggested unit was effective in developing the attitude for the research group. These results agree with those of several studies which tackled the attitude whether towards science or towards the dimensions of awareness in particular such as the studies of, Abdel Salam (2013), Abdel Samiea (2007), Abdou (1998), Abu Nagy (2003), Mohamed (2014), and Mohamed and Hasan (2004),.
3. There is a clear increase in the research group students' mean scores in the test for the ability to deal in real life situations as a whole and in all its sub-dimensions (environmental, health, and technological awareness) in

the post-application which emphasizes the effectiveness of the suggested unit in developing the hearing impaired students' awareness towards dealing in real life situations. These results agree with those of the studies which tackled developing awareness in general or preventive awareness in particular such as the studies of Ahmed (2008), Mohamed (2014), Nashwan and Abu Qamar (2004), and Radwan (2005).

Conclusion

In light of the research's conclusions regarding the requirements for designing science curricula for the hearing impaired primary stage students and suggesting a science curriculum for that stage, the researcher suggests the following:

1. Providing rooms for educational sources at Al Amal Schools for the hearing impaired students for the various stages to make use of them in performing different activities, as well as providing the necessary scientific devices such as computers, projectors, and video sets.
2. Considering the preparation of special curricula for teaching science to the hearing impaired students at the preparatory and secondary stages according to their characteristics and needs.
3. Considering the preparation of labs which enhance science teaching and providing simplified scientific books which contribute to science curricula at the different stages including images and signs that help the hearing impaired read the books and consider their characteristics and needs.
4. The necessity of creating new methods and techniques for assessing science teaching for the hearing impaired students to discover their abilities and guide them in a way that lets their abilities grow to the maximum extent.
5. There should be a teacher's guide that assists the teacher regarding teaching methods, aids, and activities appropriate for each lesson. In addition, there should be images for the signs associated with scientific concepts in

the school book so that the hearing impaired students would understand the lesson to a great extent.

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