

Awakeness, Awareness and Learning Mathematics for Arab Students: A Pilot Study

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Abstract—This paper aimed at discussing how to urge middle and high school Arab students in Israel to be aware of the importance of and investing in learning mathematics. In the first phase of the study, three questionnaires were passed to two nine-grade classes, one on Awareness, one on Awakeness and one on Learning. One of the two classes was an outstanding class from a public school (PUBS) of 31 students, and the other a heterogeneous class from a private school (PRIS) with 31 students. The Learning questionnaire which was administrated to the Awareness and Awareness topics was passed to PRIS and the Awareness and Awareness Questionnaires were passed to the PUBS class. After two months we passed the post-questionnaire to both classes to validate the long-term impact of the study. The findings of the study show that awakeness and awareness processes have an effect on the math learning process, on its context in students' daily lives and their growing interest in learning math.

Keywords—Awakeness, awareness, learning mathematics, pupils.

I. INTRODUCTION

THE aim of this pilot study is to shove Arab pupils of the middle and high school in Israel to sink in learning mathematics and to be conscious of its importance. This is done through emphasizing the capabilities of the device that they carry in their hands, “the smartphone”, and how essential is mathematics in our daily life and its applications. Based on three steps, we invoke the pupils with information close to their interest being social, psychological, or otherwise, pertaining to their immediate needs that awakens their senses at first. This is followed by indulging the pupils in a deep study of real information about the subject matter to the extent they become aware of the mathematics that is involved in it. Finally, the process of learning mathematics starts, when the individual becomes eager to solve the problems, get correct answers, and seek the right interpretation. Here and henceforth, we use the word “pupil” for a student from the pilot, otherwise we use the word “student”.

The choice of the subject matter was a result of two heterogeneous classes other than those of the pilot that we involved aside. The pilot is administered to 61 9th grade pupils from two schools of mixed gender. 31 outstanding pupils in a PUBS are mostly of lower than the middle socio-economic class, and 31 of heterogeneous pupils in a PRIS mostly from the middle class.

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Our start point was to check the students' attitude in class to the learning process and to the smartphone. Observations of the pupils in class and interviews of the teachers showed that there is no major difference between the two classes in their attitude to learning neither any difference in their dependence on the smartphone. They are close to the typical Z generation; though in some aspects such as behavior in class, the teachers are assertive since the pupils' attention is absorbed in the device between their hands. This is why the teachers are forced, not once, to comment the students to participate in the lessons. The PUBS teacher used the Geogebra application and PowerPoint for illustrative purposes only and the PRIS teacher never experienced teaching with information technology devices. Though all the students carried smartphones, they never used it in their studies. This was the first time ever to use their smartphones to study mathematics. The PUBS class is of outstanding 31 pupils, whereas the PRIS class is heterogeneous with 31 pupils. The PUBS class was tested to see their interest with this approach of teaching and so they were asked to answer the Awakeness and awareness questionnaire and did not need the learning questionnaire. The PRIS class was asked to answer the learning questionnaire which involved mathematical problems of interest to them, to see if the questionnaire would intrigue them enough to do their homework (see the last paragraph of Section II B). Two months later both classes were asked to fill the post-questionnaire and at the same time we held the interviews with the teachers.

Our study of the model Awakeness, Awareness, Learning (AAL) has two facets, one face is educational and another is learning mathematics. The awakeness and awareness serve to educate students and raise their interest in search for answers to real life problems that they face at this particular age, and the learning process is the outcome of the way that leads to the answers of these problems. In this pilot study all this is done via the most valuable asset of the pupils, the smartphone. There was no intervention in the process of this study neither from the researchers nor from the teachers, except for directing them to the appropriate website.

Our approach to this pilot is qualitative exploratory multi case study that seeks behavioral and learning changes in the students, based on data, pre and post questionnaires, and interviews with the teachers. Other than the interviews, all data were collected through the website.

II. LITERATURE REVIEW

A. Awakeness, Awareness and Learning

The scholars of education and psychology point out that

Awakeness lead students to learn. According to [2] the concept of *wide-awakeness* is “awareness of what it is to be in the world”. He suggests that a critical pedagogy of wide-Awakeness empowers learners to be mindful of themselves and others, opening up space for conscious consideration of how the world is constructed in terms of knowledge, power, and inequality. Reference [4] added that there is an important interconnection between the human awakeness and his ability to learn the information that he focuses on. He mentioned that an awake student is one who not only has his eyes open, but also is able to pay attention with his whole heart and mind, with a passion for what he is learning and doing.

As of awareness, scholars point out that awareness also leads to learning. The concepts of [6] of the class as a learning community were incorporated into theories of ‘reflective variation’ which referred to [8], and ‘awareness’ which referred to [7]. According to [1], critical consciousness, or *conscientization*, is related to raising consciousness in students to unmask oppression and liberate the capacity to learn, imagine, act and openly dialogue with the world.

In this study we tried to emphasize that teaching students of the Generation Z, is to be preceded by awakeness and awareness when needed.

B. Awakeness

In order to attract students' attention to learning, we as teachers (and parents) need to look for matters that intrigue them, that they are accustomed to, and that is easily accessible to them. Once done, the awakening procedure pops up when we provide them with data that attract them. At this stage, Awakeness opens students' appetite to the knowledge of the subject matter.

In this age of distraction, because of the many information technology devices with applications such as WhatsApp, Facebook and Email, some contemporary researchers talk about the Awakeness phase, because there is going to be a clear separation that differentiates the quality of the pupils who achieve success from those who do not [4]. Howells [4] thinks that it is not just the knowledge that we are learning that is important, but the character that pupils bring to their leaning which makes it exist and brings them into the state of awakeness (inner attitude). He adds, gratitude helps us move away from taking things for granted and therefore helps to be more awake, more alive.

Teachers use wide-Awakeness in order to awake the students to interest them in mathematics [13]. This expresses breeding as a fostering climate of the classroom of meaningful curricular experience and pluralistic dialogue.

C. Awareness

Awareness is the situation or capacity to feel, to perceive or to aware of sensory essence forms [5]. Awareness is realizing or having knowledge of something. Also, awareness is being interested in and knowing about something [9]. Reference [11] points out that the individual should have six characteristics in order to achieve self-directed learning process, the first of which is awareness to the need of learning. In order to

motivate students to learn mathematics out of desire we should give them hope in the future, educate them on recognition and gratitude, urge them to look at things in a positive way, and let them feel conscious of the subjects that they learn.

D. Learning and Social Networks

Learning is the process of acquiring new, or modifying existing knowledge, behaviors, skills, values, or preferences. The learning process is not only for passing material to the students; it must work on the individual's personal development and also emphasize that the student will learn with a positive feeling and support an inner desire to learn [12]. Reference [14] states that the social networks help the teacher to activate pupils in the learning process, provide more opportunities for perceiving and understanding the material. Using approaches like active learning, hybrid learning and corporative learning contributes to teaching the material more effectively and attractively. The social networks can also contribute to develop the pupil's cooperative learning, provision of feedback and creativity.

III. THE PILOT AND METHODOLOGY

A. The Plan

The aforementioned literature review suggests the use of social networks as a helping feature in the learning process, if used as an extra method in the teaching process. The fact is that every student has a smartphone and already used it from early age. The teaching process that we suggest for modern teaching is to approach the students through the social networks and awake them to real life problems that are of interest to them. From this stage on, the student who becomes interested to seek deeper understanding of the subject matter, (whereby the awareness process starts) are backed up to promote their awareness. Finally, the teaching process starts once the students show interest and motivation to learn.

B. The Choice of the Awakeness Topic

We first searched for topics that could possibly raise the students' attention. The first two were related directly with the smartphone, one is the Pixels and Photos empathizing how large a pixel that our sight cannot detect and how far we can see details of photos. The other one was to use an application that approximates one's footprint and encourage the pupils to practice walking as a means to protect the well-being of their bodies. The third topic was warning the pupils who are on the verge of getting a driver's license to be aware of fast driving as most accidents in the country are attributed to juveniles. The fourth topic, that was most appreciated by the pupils, was *body-building* for males, nick named *shapely-body* for females. This last issue was chosen by a similar class other than those of the pilot unanimously, and we set for it.

During the exploration, we passed questionnaires to several classes on the awakeness and awareness on other topics which revealed the students' impatience expressing that the questions are repeated. Accordingly, to minimize the length of the questionnaires we limited the study to two questionnaires on awareness and awakeness to the PUBS class and one

questionnaire to the PRIS class.

C. The Questionnaire

The first questionnaire that was passed to the pupils was on awakeness. The first paragraph of the questionnaire, five or six lines on obesity and thinness, hit them with sudden. It stated that "Obesity contributes to raising the risk of morbidity and mortality.", and about thinness that "Voluntary starvation and poor nutrition ... may lead to psychiatric illness and anorexia." This may be stressful to the pupils but it is also educational. We note that the Israeli Ministry of Health advertises this information in every central clinic in the country in these words [3], [10].

The pupils' response was that they wanted to know more about the subject on their own without our help. This is typical teenagers' behavior. Once the subject got their attention and interest, we suggested that they research the subject on the web. This led almost all to show interest in the subject.

The next questionnaire, the awareness one, had more impact on the pupils. It starts with an introduction of the common body mass index (BMI) which by a simple calculation shows where one stands within the obesity table. It was not surprising that all the pupils without any exception answered the questionnaire, even those who thought that they do not need help.

Lastly, we continued the learning process through a questionnaire with challenging questions regarding the pupil's health balance, past, present and future thereby encouraging all, even those who were in the normal category, to check if they remain in the same category five years from now. Here too all the pupils participated. This indicates how much this questionnaire arouse students' awareness to the role of mathematics in real life problems.

It should be noted that all information used and reported to the pupils as well as guiding them to information from the internet were from reliable sources of the State of Israel.

D. The Topic of Study

This pilot study is based on the mathematical subject "arithmetic of percentages" via Bodybuilding and Shapely body (BS). These topics interest mostly middle and high school students at this age.

The activity that was given to the pupils was through the smartphone. The catalyst which urged the pupils to cooperate with the study is their curiosity to know to which BMI category they belong. This demanded some preparation of measuring their height and their weight to calculate their BMI index and check their BMI category. This urged them to answer all the questions of the learning questionnaire. The problems of predicting their weight in 5 years ahead to know to which BMI category they belong demand working with arithmetic of percentages. These problems were answered by all the pupils. It is not the case that all the pupils knew how to work the problem, but it indicates the tendency to put effort to do the calculation correctly.

E. The Pilot

The preparatory stage of choosing the BS subject was the

result of two unrelated classes who gave priority to BS. One of these classes chose it unanimously. We emphasize that the preparatory stage was influential and affected our approach to the pilot. One class did not cooperate fully. The second class fully cooperated and its answer helped shape our pilot. First, the pupils gave preference to the smartphone approach versus the traditional way of learning, then, all of them solved an arithmetical problem, and thirdly the average time of their answers was very fast to the amazement of their teacher.

We were set to study two classes. In the PUBS class we chose to go through the two stages of Awakeness and awareness. In the PRIS we chose to go directly to the learning questionnaire. This choice meant to study the learning process with and without preparation and check the effect of the learning process on the students. The post-questionnaire to both classes and the interviews with the teachers were administered two months later, to examine long-term effect. The questions we sought to study are:

1. Do Awakeness and awareness have any effect on Arab students to the importance of mathematics in our daily life?
2. Can the model of Awakeness, awareness, and learning increase the interest to study mathematics of Arab students?
3. Can Information technology devices contribute to Arab students in their mathematics studies?

F. The Collection of Data

We used the smartphone and its applications, our data included the questions answered by each pupil, listing the time of submission of the questionnaire, and correctness of the solutions of the mathematical problems.

The answers of the pupils on the AAL and post questionnaire of multiple choice and open questions were transferred automatically to the smartphone of the first author. The data included the date and time of the submission that gave us another dimension to study. The post-questionnaire and interviews with their teachers were done two months later. Our aim was to collect insight into the pupils and teachers' perceptions from the pilot.

IV. ANALYSIS OF DATA

A. The PUBS Class Versus the PRIS Class of the Pilot

Bearing in mind that the PUBS class comprise 31 outstanding pupils, we intentionally decided that the learning questionnaire is not relevant to them. Our intention was to see if excelled students increase their interest in studying mathematics and have any interest in changing the style of their study. After all, the smartphone is there to ease and fasten their educational and mental advancement among other things. Indeed, the educational information in the two above-mentioned questionnaires transcends the learning process, however, few understandings that we could sum up from their answers that pertain to the learning process indicate to some extent the openness of the pupils to the importance of mathematics in their lives, and to study mathematics in a

different way.

The PRIS class is a normal class and our intention was focused on their interest to answer the mathematical problems only. Since the subject matter is incorporated in the problems of the learning questionnaire, we wished to study the effect of the subject matter on increasing their interest in studying mathematics and if it had a direct effect on the study of mathematics. The subject matter actually increased their awakesness and awareness independently from the first two questionnaires and in this case too we found interesting insights.

B. Analysis of the Awakeness and Awareness of the PUBS Class

The first paragraph about the dangers of “obesity and thinness” had its effect. In the first part of the questionnaire, all the PUBS pupils’ either knew their weight or cared to know their weight. More significant was that most of the pupils (62%) were interested to know more on the subject and although they were offered help, they rejected that and preferred to inquire into it on their own. This indicates one-step towards the Awakeness stage.

In the second part, 58% perceived themselves to have consistent weight and height and considered themselves fit, yet introducing the BMI index that measures fitness, all of the pupils became interested to know more on the subject. This was an indication that they surpassed the Awakeness stage.

In the Awareness questionnaire, 70% proclaimed that the subject matter increased their interest in mathematics which is rather strange for an outstanding class. This seemed to indicate that the pupils were unaware of the application of mathematics in daily life. When asked if they intend to pursue their attention to maintain fitness, some commented in ow “sure, especially at this age” and “yes, I would like to have lectures on the subject”. From the teacher interview, we learned that the pupils approached him to know more on the subject matter, and often asked him about the results of this research.

C. The Learning Questionnaire for the PRIS Class

In the PRIS class the awakesness and awareness were hidden behind the learning process questions. To start with, we should indicate that all the class answered all the questions of the learning and post questionnaires, however 6% of the pupils failed in calculating their BMI and 18% of the class failed to calculate their expected height and weight 5 years from now. This was an indication that the class is heterogeneous and that all the pupils had interest of the subject matter. This was also clear from their answers to the question “According to the table above do you have a normal weight” where all the pupils gave correct answers. We figured out that 79% wanted to know more on the subject matter from their answer to the question “What do you plan to do at age 19 according to the expected BMI at that age.” This was confirmed in the post-questionnaire from their answer to “Did the method of displaying the questions in the learning questionnaire helped you in terms of education, health, etc.”

From the teacher interview we learned that she did not

incorporate any teaching technological tools in her class. Her feeling was that most of the pupils were not affected by the introduction of technical tools but simply the pilot managed to get them out of the daily routine of teaching.

D. The Post-Questionnaire

Two months later we released the post-questionnaire to the two classes. In the PUBS class we realized that 60% continued to express the importance of mathematics in their daily life and in the PRIS class only 32% of the pupils increased their interest in mathematics and considered mathematics relevant in daily life. On the use of information technology devices for the study of mathematics, half the pupils in both classes were in favor and preferred it as opposed to the traditional way.

V. DISCUSSION AND CONCLUSION

Modern teaching methods awakesness, awareness and learning have long been known to be partners in educational methods of teaching. This pilot engages these three elements in the student’s best partner, the smartphone, to enhance learning mathematics. Two classes of 31 Arab pupils in Israel took part in the pilot.

We emphasize the role of social networks in activating and enhancing the learning process. The roles of awakesness and awareness are two necessary steps to lead the student to the desire to learn, for only then the student perceive the material.

The main steps that were chosen for the pilot were:

- Introducing a subject matter of interest to the pupils at their specific age.
- Awakesness and awareness questionnaires to intrigue them to desire full knowledge of the subject matter thus its relation to mathematics, using only smartphones to prevent any intervention from teachers or researchers.
- Learning questionnaire aiming to test how the mathematics topic serves to answer their questions related to the subject matter.
- Getting them to feel the importance of mathematics in their daily life.

The subject matter that was chosen out of four choices presented to two classes other than those of the pilot was *body building* or *shapely body*. This was coupled with *obesity and thinness* where on one side we introduce the danger caused by these and on the other side prevention and procedure to come out of falling into or falls in one of these two categories. The pupils had to solve mathematical problems in arithmetic of percentages to know where they stand. In this case, the BMI played a crucial role.

The questions we sought to study were: Do Awakesness and awareness have any effect on Arab students to the importance of mathematics in our daily life, can the model of Awakesness, awareness, and learning increase the interest to study mathematics of the students, and can Information technology devices contribute to their mathematics study?

Three questionnaires were prepared, one on the Awakesness, one on the awareness and one on learning. The pilot was administered to two nine grade classes. One is in a PUBS of 31 outstanding pupils and one in a PRIS with 31

heterogeneous pupils. The awakens and awareness questionnaires were administered to the PUBS knowing that there is no need to indulge them in an elementary learning one. The learning questionnaire was intended to the PRIS where the awakens and awareness issues were implicit in it. Two months later we passed a post questionnaire to both classes to check the long-term effect of the study. Noteworthy to mention that there was no intervention or contact from our side with the pupils as all the work was done via a website. The pupils had the free will to answer the questionnaires. The data were received electronically on the cell phone of the second researcher including the time of submission.

The awakens and awareness questionnaires of the PUBS class showed its effect on the educational subject of Body Building and Shapely Body. On the first two questions, 70% of them accepted the saying that these questionnaires increased their interest in mathematics which seems strange to hear it from an outstanding class. This stands out in the post questionnaire where 60% expressed the importance of mathematics in daily life.

As to the PRIS class we noticed that 6% failed to calculate their BMI and 18% failed to calculate their expected height and weight 5 years ahead. This indicated a heterogeneous class. We figured out that 79% of the pupils were affected by the subject matter. The post questionnaire revealed that 32% of the pupils expressed increased interest in mathematics and agreed that mathematics is important in daily life. Interestingly enough, on the first question half of the pupils of both classes agreed that the use of the smartphone is preferred as opposed the traditional teaching.

For the time being our study indicate that in any class the Awakens and awareness processes has effect on the learning process of mathematics, in understanding the role of its use in the students' daily life and in increasing the interest in the study of mathematics. These two processes should be brought up to the students separately and not implicitly in the learning process. The information technology devices that are thought of as distractive to the learning process can be used effectively to enhance it. The smartphone has proven to facilitate communication among people, wide open book of knowledge, can facilitate communal study thus fostering and nurturing a classroom climate and meaningful curricular experience.

This is a preliminary pilot with two classes to study important questions in mathematical learning of students. Our main objective is to continue the study at a large scale in middle schools. Future study should examine primary schools and high schools and not only in the Arab society. Another venue of research is values education in the mathematics class which should not differ from any other subject taught in class.

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