**The Impact of Moving Images in Teaching the Solar System to Children Aged 5-6 on Motivation, Knowledge, and Higher Skill Acquisition[[1]](#footnote-1)**

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Abstract

Preschool children are highly motivated to study scientific topics, a motivation which declines as they grow. Can this phenomenon be prevented? Does the solution lie in incorporating Information Communication Technologies (ICT) in teaching? Such technologies have been found to contribute to increased motivation in learning scientific topics as well as better understanding, particularly of abstract concepts, among young children.

The current study examines the effects of incorporating moving images on motivation to study the solar system, understanding the topic, and the ability to apply the knowledge acquired, compared to the effect of incorporating the same images but still. The research was conducted among children aged 5-6 in two mandatory kindergarten classes in Beer Sheva. One kindergarten served as the experimental group where the topic was taught using moving images; the other kindergarten was the control group where the topic was taught using still images. Each kindergarten class consisted of 35 children. The research focused on the solar system as an abstract topic that can be rendered concretely using digital media. One of the findings was that the incorporation of moving images as opposed to still images had little positive effect on motivation.

Children in the experimental group significantly had improved the knowledge of the solar system compared to the children in the control group (90 percent versus 62 percent respectively). The research showed that the children who learned the topic using moving images understood the topic better than the children who learned the topic using the same still images, and 80 percent of the children in the experimental group built a correct model of the solar system compared to only 54 percent of the children in the control group. It seems that the use of moving images allowed for an optimal assimilation of a three-dimensional reality.

The research may have implications for early childhood education provided kindergarten teachers are appropriately trained and provided the development of appropriate computer applications.

Keywords:

**The Impact of Moving Images in Teaching the Solar System to Children Aged 5-6 on Motivation, Knowledge, and Higher Skill Acquisition**

**The Teaching of Science in Kindergarten Using Computers**

Studying science means learning about nature and the world around us. Exposing young children to scientific topics and the essence of science—including scientific language—is critical for the development of rational thinking skills and higher order thinking (Eshach 2005). According to Constructivism, new knowledge is constructed atop of old and the more established the old knowledge is, the deeper the study of new concepts can be. Hence, the acquisition and understanding of scientific concepts at the preschool stage is of critical importance.

One can see the motivation to learn and the spark of curiosity in the eyes of preschool children. But as time passes this spark dims, and motivation diminishes, research showing that pupils’ motivation to study science declines between fifth and eighth grade, especially as children approach middle school and high school (Vedder-Weiss 2011; Vedder-Weiss 2012). Raising kindergarten children’s motivation to study science while ensuring significant learning—leading to better understanding of scientific topics—could prevent the loss of interest found among middle school and older children. A preschool child’s positive attitude to science, motivation to achieve in science, and seeing science as an interesting and accessible field, are predictors of the child’s preoccupation with science and his/her achievement in the field in the short and long terms (Eshach 2005; Kampeza 2012; Slarp 2014).

This article presents the effect of moving images compared to the effect of still images on the motivation to learn and on knowledge acquired in the teaching of the solar system.

**Incorporating ICT in Teaching in General, and in Kindergarten in Particular**

The incorporation of computers in teaching, especially science teaching, began in the 1980s. The computer, and especially open tools, such as spreadsheets in biology, animation, and simulation, allow a dialog between students and the computer. In this dialog, students may, of their own initiative, give an exact instruction to the computer, and if the dialog is successful, the computer can “understand” the students and follow their instructions (Dreyfus et al. 1993). Such experiences may encourage accurate conceptualization skills and develop independent learning.

The use of computers has been shown to raise motivation and facilitate better understanding, especially of abstract topics, even among very young children. For example, incorporating computers into teaching arithmetic in kindergarten, especially addition, significantly increased knowledge in children whose level was average or lower than anticipated, compared to a control group that learned the same topic without computers (Zaranis 2016). Today, the question is not whether or not to incorporate technology in early childhood education, but rather what form it should take and what its effect is on the learning of very young children (Nikolopoulou 2015).

Animation is a computer technology creating the illusion of movement on the screen, allowing the creation of mental representations of phenomena, processes, and systems. This representation, which allows visualization of the real world, has the potential to generate better understanding of scientific topics. The use of animation is especially effective at demonstrating processes which are not naturally visibly or difficult to present in the classroom, animation and video clips relying not only on vision but also on motion and sound. Moreover, animation and video clips allow for three-dimensional viewing, an experience impossible with models or still images (Athanasios 2014; Barak and Dori 2011).

Many studies show that technology-rich environments incorporating animation-based ICT activities have great potential for learning concepts especially scientific concepts. A technological environment creates a mental model close to that of the scientist (Barak and Dori 2011; Tversky 2002; Hoffler 2007; Ghaderia 2014; Barak 2011; Baharul 2014; Athanasios 2014) in contrast to traditional learning which relies on verbal and frontal explanations (Tversky 2002). The effect of the use of computer technologies in teaching has been examined among school-aged children (Ghaderia 2014; Eshach 2005; Baharul 2014) as well as among university students (Gero 2015), but only few studies have dealt with early childhood.

Should computers be incorporated into kindergarten instruction? In the 1980s, many were opposed to the notion, but today, given the many possibilities the internet provides, it is difficult to ignore its inherent potential for enriching teaching and expanding knowledge. It is also difficult to ignore the possible contribution of an ICT environment to the language development of very young children and the contribution of computer incorporation to arithemetic teaching, especially spatial geometry, and for developing communication skills among students inside the classroom, outside the classroom, and even outside their country (Amante 2007).

The Israeli Education Ministry has formulated a policy, incorporating computers as an integral part of the curriculum based on the recognition of the importance of using computers in teaching and an understanding of the great potential of a digital environment (Adapting the school system to the twenty-first century, master plan, 2012).

[[2]](#footnote-2)

However, contradictory findings exist. According to the 2015 annual report published by the National Education Policy Center at the University of Colorado Boulder,[[3]](#footnote-3) the achievements of children in U.S. schools that incorporate technology in teaching are lower than those in schools that do not.

It is difficult to explain this finding in light of other findings, cited above, which indicate that the incorporation of computer technologies in teaching has led to improved knowledge among students.

**Science Teaching in Kindergarten**

“The Celestial Bodies” is one of the topics of the Education Ministry’s science and technology kindergarten curriculum (Science and technology curriculum, 2009, Education Ministry).[[4]](#footnote-4) Although there is a consensus regarding the importance of teaching scientific topics in kindergartens, many teachers encounter difficulties when trying to explain abstract concepts such as the solar system, especially the issue of scale. Moreover, it has been found that some kindergarten teachers are themselves misinformed when it comes to scientific topics (Eshach 2005; Kerckaertab 2015; Kampeza and Ravanis 2006).

The incorporation of computer technologies in science teaching has been found to be effective with regard to abstract topics in elementary school, middle school, high school, and university (Barak and Dori 2011; Gero 2015). Very little research has been done on the effect of the incorporation of computer technologies in teaching abstract topics in kindergarten. We therefore chose to study the effect of an ICT environment integrating moving images (in the form of video clips and animation) on the motivation to study the solar system and the ability to apply the knowledge acquired among children aged 5-6. We examined this effect compared to the effect of teaching the topic using the same still images.

**Staff Training and Incoporating ICT in the Classroom and in Kindergarten**

Proper training of teachers is a critical component (Kfir et al. 1997; Lidor et al. 2013; Lidor et al. 2015). Teacher training in Israel has undergone many reforms, including the academization of teachers and the official agenda to make the teaching profession academic. Teacher must prepare their students for a world teeming with tremendous amounts of constantly updated knowledge. Hence, teachers must posses a high level of education and professional training. Given these goals, new guidelines (preceded by guidelines from 1981) for training teachers in institutions of higher education in Israel were formulated in the Ariav Committee Report (decisions made by the Council on Higher Education in November 2006 were based on that report).[[5]](#footnote-5) The report deals with the core subjects all teaching students must study, including theories and approaches to teaching and learning **as well as the incorporation of ICT.**

A direct result of the academization and the new guidelines is the improvement in the quality of teaching candidates. The bar for accepting students at teacher training colleges is rising, while the academic faculty at colleges are now required to hold PhDs. This policy is also resulting in uniformity of the various programs used to train teaching students at institutions of higher education. Nonetheless, it is unclear if this uniformity is, in fact, leading to more effective training.

For the incorporation of ICT to be efficient and before the implementation of digital pedagogies, the following conditions must be met: the presence of computers in the classrooms rather than in computer rooms that cannot be accessed on the spot; the development of computer applications and the right selection of developed appplications, e.g. programs that stimulate children’s imagination and creativity; easy-to-operate programs and applications that can be adapted to different target groups as needed; the children’s active involvement in operating applications; acitivity that encourages sharing and collective efforts rather than competitiveness; and the incorporation of the computer only in cases in which its added value has been proven. The incorporation of computers is not the main goal, but rather a means for achieving academic aims. Of critical importance is the presence of technical personnel that can support teachers in cases of technical problems (Amante 2007).

**Program Details**

The topic was taught in two different kindergartens using the same moving or still images.

The topic was taught in two main, full-class sessions of about 20 minutes each. In these sessions, the contents adapted to the topic studied in kindergarten were transmitted in an expanded form based on a syllabus that includes the celestial bodies and focuses on the planet Earth, the moon, the sun, and other solar system planets, the features and structures of these bodies, the sun’s effect on Earth, a clarification of children’s preconceptions about Earth, and an explanation for the phenomena of day and night.

In the experimental class, groups of five children took turns sitting with the kindergarten teacher for an interactive activity on the computer that included an animated model of the solar system. In the control class, groups of five children took turns sitting around a table where the teacher used two-dimensional still images to teach the same topic. At the end of the activity, children in the different groups filled out a questionnaire with the kindergarten teachers’ help. A follow-up session to make sure the topic was assimilated was held at the end of the same day. To conclude the topic, the children in both kindergartens constructed a three-dimensional model of the solar system using Styrofoam balls of various sizes.

It is important to note that the moving images were screened on a computer whereas the still images were not. However, it seems that the differences observed between the two kindergartens did not stem from this inconsistency, but rather from the differences in the motion of the images.

Examples of lessons plans in a lesson on the solar system:

1. **The round planet Earth**, familiarity with the planet’s roundness.

In the control class, the topic was conveyed to the children using a still image of the planet, whereas in the experimental class it was transmitted using a moving image from the video clip Earth from Space – Free HD Footage.[[6]](#footnote-6)

1. **Journey to the center of Earth**, familiarity with the structure of the plant: crust, mantle, core.

In the control class, the structure of planet Earth was taught using still images, whereas in the experimental class it was taught using a video clip on the planet’s structure.[[7]](#footnote-7)

1. **The Earth and its rotation**, the making of day and night on planet Earth.



In the control class, the topic was transmitted using still images. An explanation about the rotation of the planet and the creation of day and night was provided using a globe and table lamp that represented the sun and made it clear to the children which parts of the Earth received sunlight and which remained dark.



In the experimental class, the topic was taught using video clips and animation showing the motion of planet Earth and the process of day and night.[[8]](#footnote-8)

1. **Familiarity with the moon**, and its phases.

In the control class, the topic was transmitted using still images, such as this:  In the experimental class, the topic was transmitted using a video and animation of the phases of the moon.[[9]](#footnote-9)

**The Study**

**Research Questions**

How does the motion of images (animation, video), compared to non-motion of images (static images, stills), in the teaching of the solar system to children aged 5-6 (kindergarten) affect:

1. Motivation to continue learning science, especially the solar system;
2. Knowledge about the solar system;
3. Higher-order thinking skills (understanding, the ability to apply the knowledge).

**Research Subjects**

Seventy children in two kindergartens in Beer Sheva participated in the study. The kindergartens were on similar socioeconomic levels. The initial achievement level of the children in the experimental class was somewhat lower than that of the control class. Each kindergarten class consisted of 35 children aged 5-6. See Before data in Tables 1 and 2.

**Research Tools**

Both classes, the experimental and the control, were given two questionnaires before and after the intervention.

The first questionnaire examined the children’s motivation to learn science in general and the topic of the solar system in particular. The questionnaire, taken from Barak (2002), consists of nine questions adapted to the topic studied and the subjects’ age. With the teachers’ mediation, the children were asked to rate, on a scale of 1-5, various statements about learning science in general and learning about the solar system in particular. See statements in Table 1 below.

The second questionnaire, focused on knowledge about the solar system, was taken from Rosnik (2012), and consisted of 11 questions. See statements in Table 2 below.

After the intervention and in addition to the questionnaires, the children’s understanding and ability to apply the learning acquired in the teaching of the solar system were examined by means of their ability to construct a correct three-dimensional model of the solar system using Styrofoam balls of varying sizes, with emphasis on their relative distances and sizes.

**Data Collection**

The knowledge and motivation questionnaires were filled out before and after teaching the topic, both in the control group (still images) and the experimental group (moving images).

The questionnaire was filled out with the teachers’ help, as the children cannot read and write because of their age.

As a summary of the topic studies, the children in both groups constructed a three-dimensional model of the solar system. The purpose of the activity was to examine the application of knowledge with emphasis on grasping the system’s concept. Every child received Styrofoam balls in varying sizes, colored them in the colors of the planets using frottage with modeling clay, and built his or her model with them. Every ball represented a different planet based on its relative size.

**Data Processing**

The quantitative data of the two questionnaires – the one on motivation and the one on knowledge of the topic – were processed and analyzed. Averages, standard deviation, T-tests, and a chi-square test were used to compare the two groups. Every answer in the questionnaire was encoded such that a correct answer was given the value of 2 and an incorrect answer was given the value of 0.

The averages, standard deviation of every statement in the experimental kindergarten and the control kindergarten, were calculated before and after the intervention. Likewise, a T-test was conducted to compare the groups.

**Findings**

The findings from the children’s achievements on the motivation and knowledge questionnaires as well as from a check of the application of the knowledge are presented below.

**Motivation to Learn Science in General and the Solar System in Particular after Running the Program**

As noted, motivation to learn science in general and the solar system in particular was tested using a questionnaire that contained nine statements. These were read out loud by the kindergarten teacher who also marked the children’s answers.

Table 1 presents the differences between the experimental and the control kindergartens in average responses to statements on motivation to learn science in general and the solar system in particular before and after carrying out the experiment (scale of 1-5).



**An analysis of the data** demonstrates clear differences between the kindergartens before the intervention in three of the nine statements on motivation to learn science in general and the solar system in particular: “Science activity in kindergarten fascinates me” (Statement 3); “The study of science allows me to understand daily phenomena” (Statement 5); and “I am unwilling to skip science activity” (Statement 9).

A clear gap in motivation between the experimental kindergarten and the control kindergarten was found after the intervention in the following statements: “I think that knowing science is important for children as well as adults” (Statement 7) and “I want to be a scientist when I grow up” (Statement 8). In some of the statements, motivation was higher in the experimental group (Statement 5 before intervention and Statements 7 and 8 afterwards), and in other statements, motivation was higher in the control group (Statements 3 and 9 before intervention).

These findings indicate the intervention had a minimal effect on improving motivation, especially with regard to the importance of studying science (Statement 7) and the desire to become a scientist in the future (Statement 8). In the other statements, no change in motivation was observed.

**The Program’s Contribution to Knowledge of the Solar System**

Knowledge of the solar system was tested by a knowledge questionnaire consisting of 11 questions. The children in both kindergartens were asked to answer the questionnaire before and after the intervention. The children’s average answers in both groups are presented in Table 2.

The difference between the achievements before and after teaching was calculated in both kindergartens.

**Table 2: Knowledge achievement of children in control group versus experimental group**

The points awarded each question were 0=incorrect and 2=correct. The maximal score was 22, i.e. 100 percent. The knowledge test grade was calculated in percentages.



In ten of the 11 knowledge questions, the achievements of the experimental group were higher. This was especially noticeable in questions testing scale, such as Question 4 (“What is bigger – the sun or Earth?”) and Question 11 (“What is bigger – the sun or the moon?”). Children in both kindergartens answered Question 1 (“What is the name of the planet where we live?”) correctly.

**The average final grades in both kindergartens before and after the intervention are presented in Table 3.**



**Understanding and Applying Knowledge of the Solar System**

Application of the knowledge was tested by having the children build a three-dimensional model of the solar system, with emphasis placed on scale. Below are two examples of such a model.

The findings showed that, in the experimental group, 80 percent of the children succeeded in building a correct model in which all planets were located correctly and in accordance with their relative size, compared to 54 percent of the children in the control group.

**Other Findings**

Although the topic was not included as a research question, during the study it became clear that an ICT environment has an inherent effect on children’s participation in an activity. The kindergarten teacher in the experimental class reported that, during the intervention, she succeeded in actively involving children who generally do not participate in kindergarten activities. Children who generally have difficulty expressing themselves in words found a way to express themselves in ICT activity. The children enjoyed the session and noted “It’s fun to lean with the computer” and “It’s very interesting.”

The teacher in the experimental kindergarten continued to incorporate the web-based module four years after the end of the intervention, adapting it to the composition of the children in her class.

Another issue that emerged during the research was parental attitudes to ICT. A few parents expressed concern about incorporating computers into the kindergarten, but all parents permitted their children’s participation in the classes using the computer. No systematic information was gathered on parental attitudes to ICT incorporation after the end of the intervention.

**Summary, Conclusions, and Recommendations**

In this study, we examined how activities focused on an abstract topic, such as the movement of bodies in space in the context of the relationships among Earth, the sun, and the moon, incorporating animation and video clips, contribute to the formation of a conceptual foundation among children aged 5-6, while structuring concepts relating to the solar system. We found that the incorporation of three-dimensional moving computer images compared to the same two-dimensional still images had a minimal effect on improved motivation. An effect on understanding, knowledge acquired, and the ability to apply that knowledge was observed.

Of the many teaching strategies and methods, we chose to focus on the incorporation of computer technologies in teaching science topics. This integration encourages study of new and complex topics and helps develop scientific literacy skills, cognitive skills, creative thinking, and curiosity. One explanation is that computer technologies allow the incorporation of varied teaching methods and are adapted to different learning strategies, therefore developing varied thinking skills, and are suitable to heterogeneous classrooms. The motivation questionnaire used in the study did not demonstrate clear differences in the children’s achievements in the two group except for in the statements “I think that knowing science is important for children as well as adults” (Statement 7) and “I want to be a scientist when I grow up” (Statement 8). It seems that, as a result of their experience with science lessons in kindergarten, the children succeeded in envisioning themselves as scientists in the future even though there was no clear difference in motivation between the experimental and the control groups. This datum is to a certain extent congruent with the findings of other studies showing that high motivation to study science is a predictor of scientific pursuits in adulthood (Eshach 2005; Kampeza 2012; Slarp 2014).

It may be that the statements should have been formulated less generally, more specifically aimed at the material studied, and more adapted to young children. For example, instead of “I think science is a very interesting stubject” (Statement 1), perhaps it would have been more appropriate to say “I think that what we learned about the solar system was very interesting.”

Kindergarten children were motivated to learn topics in science before the intervention (Table 1). How can the decline in motivation we observe as children grow older be halted? Teachers are the key factor in teaching in general and in teaching abstract subject in early childhood in particular. The situation becomes more complicated when teachers themselves are uninformed, lack in-depth knowledge of many topics, or have no motivation to tackle these subjects (Eshach 2005; Kerckaertab 2015). Furthermore, teacher training for working in ICT environments is generally technical, concerning itself with operating the computer rather than with subjects related to digital pedagogy, such as turning children into independent learners (Gilo 2011; Nikolopoulou 2015). Vedder-Weiss and Fortus’s study (2017) showed that the teacher’s expertise has a decisive effect on children’s motivation to study science. The writers assume that it is possible that teachers’ knowledge of scientific topics and the teaching objectives they articulate for the students also have an effect on the decline in children’s motivation to learn science (Vedder-Weiss and Fortus 2012).

The knowledge questionnaire and the application of knowledge test showed that the achievements of the children in the experimental kindergarten where video clips and animation were incorporated into the teaching of the topic were higher than those of the children in the control kindergarten in ten of the 11 questions. This was especially obvious in the questions testing scale.

This datum is also congruent with the findings of other studies testing the effect of animation on knowledge and understanding of different topics among student in secondary schools (Barak and Dori 2011; Baharul Islam 2014; Ghaderia 2014; Hoffler 2007; Rasch 2009) and even among university students (Gero, 2015). The knowledge application test showed that 80 percent of the children in the experimental groups succeeded in building a correct model of the planets. Why did the other 20 percent fail to do so? We expect the kindergarten teacher will look for the reasons for their lack of success and improve the teaching so that in the future all the children will be able to build a correct model.

From interviews with teachers, it seem that it is worth considering a different training method that would take into account function of the teacher in an ICT environment. In such settings, the teacher is not only a source of knowledge but also a guide, encouraging cooperation among the learners, and providing relevant sources of information to develop independent learners (Amante 2007). Teachers’ attitude to incorporating ICT in teaching is of decisive importance. It seems that even teachers (in kinidergartens and schools) who report a positive attitude to using ICT in teaching in practice incorporate it to a very small degree on a consistent basis. A possible reason is that teacher training is generally technical, focusing on operating the computer rather than on topics related to digital pedagogy, as mentioned above (Gilo 2011; Nikolopoulou 2015). It may be that further training in which teachers are invited to prepare lesson plans and hear concrete suggestions on ICT incorporation in the curriculum is needed (Sánchez 2012). Appropriate teacher training could significantly improve children’s learning experience in an ICT environment. Appropriate science teacher training affects student motivation to learn science and can therefore prevent or significantly reduce the decline in motivation to study science, a phenomenon observed among middle school children (Vedder-Weiss and Fortus 2017; Vedder-Weiss and Fortus 2011).

As noted above, the kingergarten teacher who participated in the study in the experimental class continues to incorporate the web-based module four years after the end of the intervention. Before the study, she did not use computer technolgies in her kindergarten classroom; it was only after she became aware of the potential inherent in animation and simulation for teaching abstract topics, and in light of the fact that she had a ready-made web-based module at her disposal, that she dared use the computer not only in the context of the study. The incorporation of ICT in her classroom allows her “to bring the solar system to the kindergarten,” as well as to bring other abstract topics to class, as she reported in an informal conversation with us.

It seems that ready-made lesson plans based on ICT animation and simulation can help preschool and school teachers incorporate computer technologies in teaching various topics in science and perhaps even tackle some of the teachers’ own misconceptions (Sánchez 2012; Gilo 2011).

Similar findings emerged from implementing a project to incorporate information technology in teaching science and agriculture before a web-based matriculation examinate in life sciences and agriculture (Talmon et al. 2007).[[10]](#footnote-10) Teachers who participated in the project explained the findings by saying that they had web-based teaching units developed by the project’s development team at their disposal. The units were adaptable based on class needs and student populations. Moreover, the teachers noted that the support of the team at all stages greatly contributed both to their desire to participate in the project and to its success (Shemesh et al 2008; Shevet 2008).

Based on the study’s findings as reported in this essay and based on other research, we recommend incorporating computer technologies at all teacher (school and kindergarten) continuing education programs, and perhaps even changing the format of these programs, e.g. actively involving teachers in preparing lesson plans incorporating ICT, developing learning materials teachers can adapt to heterogeneous classrooms, strengthening teachers’ web skills, providing scientific support for complex topics such as the solar system, and establishing virtual support groups.

Support for these ideas may also be found in the 2015 annual report by the National Education Policy Center at the University of Colorado Boulder.

The obvious conclusion to be drawn is that teachers need appropriate training that will allow them to incorporate ready-made web-based study units in their teaching while adapting them to their particular classrooms. Educators must have access to open web-based study units, just like textbooks. Trained teachers who have received the appropriate instruction can use such units and adapt them to their classrooms. Computer technologies will be incorporated only in cases where they pose a relative advantage over other methods. The idea is not for the computer to replace the teacher; the teacher’s function is highly significant because the teacher must decide what to incorporate, how to adapt the tasks to a heterogeneous class, and, in particular, determine the right measure of computer technologies used in teaching.

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1. The essay is based on an applied final project in fulfilment of the requirements of an MA in Science Education carried out by Orly Malka Hatab under the supervision of Dr. Jeanette Talmon. [↑](#footnote-ref-1)
2. <http://cms.education.gov.il/NR/rdonlyres/79B5A8CF-F812-4A63-89BE-3BEFEB887EC5/142454/12.pdf> [↑](#footnote-ref-2)
3. <http://nepc.colorado.edu/files/publications/RB-Miron%20Virtual%20Schools.pdf> <http://www.hishtalmuyot.co.il/newsletter/%D7%92%D7%99%D7%9C%D7%99%D7%95%D7%9F-679/> [↑](#footnote-ref-3)
4. <http://cms.education.gov.il/educationcms/units/tochniyot_limudim/science_tech> [↑](#footnote-ref-4)
5. <http://cms.education.gov.il/EducationCMS/Units/HachsharatOvdeyHoraa/Hozrim/MitveTudatHhoraa.htm> [↑](#footnote-ref-5)
6. <https://www.youtube.com/watch?v=Hekzoc5KnJE> [↑](#footnote-ref-6)
7. <http://www.brainpop.co.il/he/category_8/subcategory_96/subjects_879/> [↑](#footnote-ref-7)
8. <http://lib.cet.ac.il/pages/item.asp?item=20831> ; <https://www.youtube.com/watch?v=3e_Z_rMX3Ig> [↑](#footnote-ref-8)
9. <https://www.youtube.com/watch?v=GBqbQcxAICo> [↑](#footnote-ref-9)
10. http://ict-agribioed.huji.ac.il/ictportal/index.aspx [↑](#footnote-ref-10)