



## **iScientist : Bringing Scientists to Class**

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### **Abstract**

*The iScientist program brings leading scientists into the classroom for a free-flowing conversation about their scientific research via live video-chats. The main objective of this program is to provide students and their teachers from all over the country, with the rare experience of conversation with scientists in an informal manner and, as a result, cultivate the students' motivation to study sciences. Our goals are to make scientists more accessible to students and teachers, to introduce students to new role models, and to provide a framework for a new pedagogic instruction in the classroom.*

*Teachers are the key factors in the program. They choose the relevant scientist for their students; they coordinate the time and the discussed subject with the scientists, prepare the students and mediate the video conversation.*

*It is important to note that this video conversation is not a lecture. The students prepare questions prior to the video conversation with the scientist about his/her research. Before the video conversation, the teachers conduct lessons developed by the iScientist team for each scientist and his/her research, aiming at preparation of the students, and encouraging them to ask significant questions.*

*A mobile application has been developed specifically for the iScientist program. The app will enable teachers to easily search for relevant scientists, read additional background material, download the preparatory lesson, and coordinate the video conversation with the scientist.*

*Our team conducts workshops for teachers in schools, where they are trained in preparing the students, working with the scientists, operating the app, etc. We have conducted dozens of workshops with teachers, who, in turn, have conducted many iScientist lessons. We have recruited about one hundred scientists and have developed dozens of preparation lesson plans, relevant to their research. We found that the impact on students is significant, and responses are very good. For example, 80% of the students who participated in an iScientist lesson say that they would like to participate in such a lesson once again.*

**Keywords:** *Live Video, conversation, questions, teachers, scientists, students;*

### **1. Introduction**

Today, teachers should guide their students and provide them with skills set fit for the 21st century rather than being the sole source of knowledge in class. Students need to learn how to acquire knowledge on their own and how to connect to experts who hold it. Inviting scientists to classroom is a great way to practice these skills and bring meaning to a lesson. However, in many cases, time and distance make it impossible.

Video conferencing enables bringing scientists to classrooms in a click of a button, using nothing but a webcam, projector and an internet connection. This allows teachers from all over the country to host cutting edge scientists in their classroom, providing their students with an amazing experience of interviewing and connecting to these scientists.

There are various platforms utilized to bring experts to classrooms such as "Skype in the classroom" [1] and "Nepri" [2]. These platforms are great for inspiring students and introduce them to new role models in all the disciplines. The iScientist program of the Davidson Institute of Science Education [3] has similarities to the mentioned platforms; however, it is different in its pedagogical methodologies and in its focus on STEM experts. The iScientist program was developed based on the "Livot Olam" initiative [4].

### **2. Method**

The iScientist program allows free-flowing conversation between teachers, students and the scientists in an informal Q & A type setting. The scientists are not expected to deliver lectures, and do not need to prepare anything in advance.

The teachers' roll in iScientist is most significant. The teachers decide which scientist to invite for a conversation with their students, at what part of the school year, to match expectations with the scientist, to prepare the students, to mediate the conversation itself and to summarize it.

There is no doubt that the gap of knowledge between scientists and school students is huge. We do not expect teachers and students to close this gap, but we aim at rising the students' curiosity and

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encouraging them to ask questions, the true engine of science. We found that the task of asking a question is not simple for students. Since first grade, they are praised for giving the right answers and penalized for wrong ones. Moreover, the task of encouraging students to ask questions is not simple for teachers. They have to keep up with the curriculum and do not have enough time for honing this important skill. We guide teachers on how to prepare students for conversing with scientists, rising questions and not just gaining knowledge.

### 2.1. Preparation lessons

The program's team is developing a specific preparation lesson for each scientist. These lessons aim at helping teachers in bridging the scientific knowledge gap by engaging the students with the scientists' research and encourage them to ask questions. The preparation lessons use a variety of games, challenges and activities and usually also include some information about the scientist and his/her work.

An example for such an activity is a game about cells communication:

Dr. David Sprinzak, a Weizmann Institute alumnus, currently a researcher at the Tel Aviv University, uses a systems biology approach to study developmental systems. One of his model systems is the development of organized checkerboard-like pattern of hair cells and supporting cells in the inner ear [3]. In order to help students with raising questions about such a complex subject, we developed a game: Students are sitting in parallel rows and given envelopes containing one black and one white ticket and a paper clip. To succeed in the game, the students need to create a checkerboard pattern. The rules of the game are: (1) Attaching the paper clip to one of the tickets signifies choosing the relevant color. (2) Students are not allowed to speak to each other, (3) Students are not allowed to take the tickets out of the envelope. (4) They can write notes to each other and (5) they can ask the teacher any question they want.

The most common question asked are:

- Can I tell my neighbor which color I am?
- Do I have to write to my closest neighbors or can I pass a note to a further one?
- I am getting conflicting messages. What should I do?

Those questions about the game can be easily "translated" to questions about cells communication:

- Can a cell communicate with his neighbor and "tell" him what his role is?
- Does a cell communicate only with his closest neighbors or can it communicate with cells further away as well?
- What happens when a cell gets conflicting messages?

When Dr. Sprinzak "meets" the students in the video conversation, they can discuss these questions with him.

This preparation lesson is an example for a lesson that enables students to ask relevant, meaningful questions about the scientist's work and its scientific background without requiring the teacher and the students to fully understand it.

### 2.2. Teachers' Training and Support

The program provides teachers with training and support. The training includes two short workshops in their own school, with the entire science teachers' team. On the first workshop, the teachers experience a preparation lesson as students, and practice raising questions themselves. We discuss the importance of question asking by students, how to use it as a tool in class and how to encourage it. On the second workshop, the teachers gather up and "meet" with one of the program staff on a video chat. This workshop is a short simulation of a video conversation with a scientist. The teachers have to handle the technical challenges of the video conversation in their class, they learn how to adjust the camera in the classroom, how to mediate the video conversation and how to bridge between the scientist and the students.

On the first iScientist lesson teachers perform, we offer pedagogical and technical assistance. We arrive with a kit including a laptop, a webcam, a set of speakers and a smartphone used as a WiFi hot spot. In a case a technical problem occurs, we help the teacher in streaming the video conference. Pedagogical and technical support by telephone and e-mail is continuously offered to all participating teachers.

### 2.3. The iScientist App

We have developed a mobile application that enables teachers to easily search for relevant scientists, read additional background material, select and coordinate the video conversation with a specific scientist. It also sets the conversation date in the participants' calendars, sends reminders, and enables us to monitor the administrative aspects of the conversations.

To enrich the scientists' profiles, we have filmed short, two-minute videos of the scientists and loaded it to the mobile app. In these videos, the scientists talk about themselves and their research. The scientists' profiles also contain a link to the preparation lessons.



### 3. Metrics and evaluation

During our pilot and development year, we have recruited to the program more than 100 scientists; most of them are Weizmann Institute's PI's, students and alumni. Until January 2018, a few dozens of iScientist lessons have taken place with students and teachers, and 150 teachers were trained in iScientist workshops.

The Davidson Institute evaluation unit has been evaluating the iScientist program using questionnaires answered by teachers, experts and students who participate in the program. We received answers from 90 students, 16 scientists and 12 teachers. All the questionnaires were analyzed. The evaluation unit staff also observed ten iScientist lessons in nine localities throughout the country, in both high and middle schools, focusing on their pedagogic and technical aspects. The observations included the preparation lessons, the video conversation and a short interview with the teachers. That data collection phase began in February 2017 and ended in June 2017.

The findings of both, the questionnaires and the observations indicate a high level of satisfaction. Conversations with scientists through video conference were characterized by the level of listening, students' involvement, and lesson's atmosphere. The results indicate that the iScientist lessons are experienced and perceived as enriching, interesting and challenging. 80% of the students were confident that they want to participate in such a lesson in the future and another 18% may want to participate in such a lesson again. The teachers' degree of confidence in the students' desire to participate in the future is also high.

The attitude towards the program was very positive among both, teachers and scientists.

Some teachers' citations:

- "The students did not stop asking questions, and when the conversation disconnected after more than 35 minutes, the students asked to try and reconnect and so we did"
- "The scientist was so pleasant, understandable, interesting, and respectful; it was a pure pleasure to work with him"

From students' comments:

- "I would like to study physics in the future like you"
- "You explain really, really well! I hope the research on this topic is successful"
- "It is a great way to transfer information"

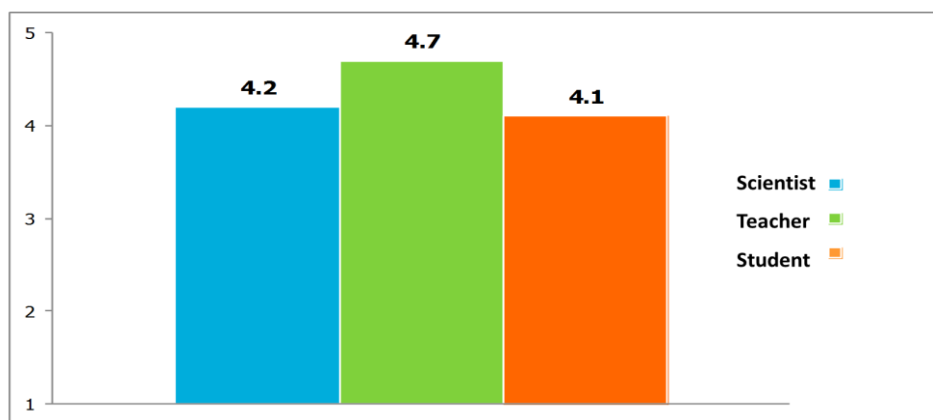


Figure 1: attitudes of students, scientists, and teachers towards the lesson, average on scale 1-5



Figure 2: Students' views after a lesson, average on the 1-5 scale



#### 4. Summary

In this paper, we presented the iScientist program that enables teachers to invite scientists to a video conversation with their students. This is a novel program that brings new pedagogy and cutting edge science into the classroom. Our vision is to make such conversations a standard teaching tool. We wish that teachers all over the country would have the opportunity to invite scientists to talk to their students in such informal conversations, giving them the opportunity to take a glance on cutting-edge science and meet scientists as possible role models.

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