**（For JSPS Fellow）**

**Form B-5**

Date（日付）
　3/2/2016　　（Date/Month/Year：日/月/年）

# Activity Report -Science Dialogue Program-
（サイエンス・ダイアログ事業　実施報告書）

- Fellow's name（講師氏名）:　ID No.　P15751　　Isac Heden

- Participating school（学校名）: Shizuoka Kita High Shool

-Date　（実施日時）:1/2/2016（Date/Month/Year:日/月/年）

- Lecture title（講演題目）:　（in English）Algebra, geometry and two illustrations.

　　　　　　　　　　　　（in Japanese）-

- Lecture summary（講演概要）: Please summary your lecture 200-500 words.

My research field in Mathematics is Algebraic Geometry. I started by giving a short introduction to what algebra is about (numbers, polynomials, arithmetic operations, solving equations,...), what geometry is about (points, curves, surfaces, shapes, areas, volumes, angles,...), and showed how these things are related to each other. For instance, the circle (geometry) can be defined as the set of points in the plane that satisfy a certain polynomial equation (algebra).

Then I compared mathematics with other natural sciences. Mathematics studies abstract objects that don't exist in the real world, as opposed to Biology, Physics or Chemistry,... that study things (living organisms, materials, chemical reactions) that you can touch, look at in a microscope, measure temperature, etc. Yet, even if we study abstract objects in mathematics, mathematics turns out to be useful in other sciences, and various applications. I gave examples, such as the importance of prime numbers for communication over internet (cryptography and error-correcting codes).

The main part of my talk (approx. 30+30 minutes) consisted of two mathematical illustrations, showing surprising connections between algebra and geometry. The first was "Conway's knot dance". I brought 2 ropes for this, and asked 4 volunteers to hold one rope end each. The other 86 persons in the room participated by giving instructions to the 4 volunteers. Two different moves, called twist and turn, were introduced. Performing these moves while holding on to a rope end causes the ropes to be "tangled", and to each tangle is associated a rational number. The two dance moves correspond precisely to two arithmetic operations that are performed on this rational number, and it was a fun exercise for the students to try to bring the ropes back to the starting configuration using only the given dance moves and the rational number associated to the knot. The second illustration was "the picture hanging problem" - an easy accessible way of understanding an instance of an important geometrical/topological concept: the fundamental

group of the plane punctured at k points (that is, the free group on k generators). I gave as an exercise to produce elements in this fundamental group that have some interesting properties, and the students (divided into nine groups) were able to do this quite successfully and quite enthusiastically with the equipment I had brought.

After a short break, I finished by talking for about 10 minutes about myself, how I became a mathematician and why I enjoy it so much to do mathematics. Also about the Nobel prize – the prestigious prize in science that is awarded in Chemistry, Economy, Literature, Medicine, Peace and Physics every year by the Swedish king. There is no Nobel prize in mathematics, but we instead have the Fields medal, which is awarded every four years to a mathematician under 40 years of age. Then I wished them all the best for their studies in mathematics and (jokingly) told them that they better get going quite quickly if they want to have a chance to one day win a Fields medal.

- Language used（使用言語）: English

- Lecture format（講演形式）:
 ◆Lecture time（講演時間）　100　min（分）, Q&A time（質疑応答時間）10　min（分）
 ◆Lecture style(ex.: used projector, conducted experiments)
　　（講演方法（例：プロジェクター使用による講演、実験・実習の有無など））
Talk, with key words and extensive illustrations drawn on the whiteboard. Used wooden equipment and ropes/strings for hands-on activities.
 ◆Interpretation(ex.: assistance by accompanied person, provided Japanese explanation by yourself)（通訳（例：同行者によるサポート、講師本人による日本語説明））My contact person, Dr. Takahashi from Shizuoka Kita High School translated some parts of the lecture for me – other parts needed no translation. From seeing pictures on the whiteboard and seeing the equipment, it was (hopefully) clear to the students what was going on, and many seemed to grasp what was needed for the hands-on exercises.

 ◆Name and title of accompanied person（同行者 職・氏名）

 ◆Other note worthy information（その他特筆すべき事項）:
　I would have liked to have a chance to meet the students informally after the lecture and talk individually with some of them, but this possibility was not given. Probably because of tight schedule and their next class starting. I would also have enjoyed to have some more time to meet the mathematics teachers to know about what it is like to be a High School mathematics teacher in Japan – but not so much time for this kind of informal interaction was given. My contact person (Dr. Midori Takahashi) was the only person that I got to speak a little with outside the actual talk.

- Impressions and opinions from accompanied person
（同行者の方から、本事業に対する意見・感想等がありましたら、お願いいたします。）: