



Instructional Strategies: Using STEM for High School Students

Startalk Conference, May 4, 2013

Svetlana Abramova, Ph.D., Lead Instructor for the Russian Student Startalk Program at the University of Washington

Lena Doubivko, Ph.C., Program Director for the Russian Student Startalk Program at the University of Washington

Michele Anciaux Aoki, Ph.D., Program Supervisor, World Languages and International Education, State of Washington Office of Superintendent of Public Instruction

Our Presentation Addresses the Following Questions:

- How can we expand students' language proficiency through a focus on STEM (Science, Technology, Engineering and Mathematics) component?
- How can trips to the Seattle Museum of Flight give the students access to authentic materials from space exploration, airplane flight simulations and make the learning of complex vocabulary and language structures worthwhile?
- How can Interviews with Russian-speaking professionals from Microsoft and Boeing immerse students in meaningful communication on target language?



Instructional Strategies*

- Implementing a Standards-Based and Thematically Organized Curriculum
- Facilitating a Learner-Centered Classroom
- Using the Target Language and Providing Comprehensible Input for Instruction
- Integrating Culture, Content, and Language in a World Language Classroom
- Adapting and Using Age-Appropriate Authentic Materials
- Conducting Performance-Based Assessment

* Based on the STARTALK Principles

UW STARTALK Russian Student Program 2012

- *Russian in the Sky and Outer Space;*
- 4-week intensive (5 hours/day) language program at the University of Washington
- Designed for Russian Heritage Learners (high school age)
- Focus on STEM (Science, Technology, Engineering, Math) and academic language style

UW STARTALK 2012 Student Profiles

- 21 students (ages 14-18 years old)
- Born in the US or arrived before age 3 **(10)**
- Age at immigration: 4-9 **(7)**
- Age at immigration: 9-14 **(4)**
- Students' language proficiency (according to ACTFL Proficiency Guidelines):
 - Intermediate or higher in Speaking/Listening
 - Novice Mid or higher in Reading/Writing

Heritage Language Learner Profile: Oral Performance Characteristics

- Pronunciation/intonation – **Americanized/Native-like**
- Mispronunciations – **Yes**
- Borrowings – **Yes**
- Speech rate – **Native-like**
- Lexical errors – **Yes**
- Grammatical errors – **Yes**
- Word order – **Americanized/Native-like**
- Complex syntax – **Some**
- Code-switching – **Yes**
- Awareness of register – **No**

Getting HLL to a Higher Proficiency Level

According to C. Martin, instruction should focus on:

- Awareness of what is defined as Superior level language
 - Functions, contexts and content areas, text type, and expectations for accuracy
- Expansion of contexts and content areas beyond personal and anecdotal
- Expansion of the lexical base to include precise (rather than generic) vocabulary
- Producing coherent extended discourse that goes beyond the single paragraph
- Dealing with topics from an abstract perspective

Martin, C. Exploring Linguistic Profiles of Heritage Speakers of Spanish and Russian. A NHLRC/ACTFL Project. A presentation at Sixth Heritage Language Research Institute

The Program Goals

- Increase students' proficiency in all three modes of communication
 - Interpersonal
 - Interpretive Listening and Reading
 - Presentational Writing and Speaking
- Increase sensitivity to cultural norms: social register and linguistic forms not typically encountered in intimate family speech
- Interpretive and presentational modes: strengthen students' skills in Russian, especially in academic language across disciplines
- Sharpen students general communication skills in varied disciplines by meeting with Russian-speaking professionals

STEM: What is it?

- **Science, Technology, Engineering, and Mathematics**
- Program started by Judith A. Ramaley, former director of the National Science Foundation's education and human-resources division.
- Designed to revolutionize the teaching of subject areas such as mathematics and science by incorporating technology and engineering into regular curriculum by creating a “meta-discipline.”

STEM: More than 4 subjects

- STEM Education attempts to transform the typical teacher-centered classroom by encouraging a curriculum that is driven by **problem-solving, discovery, exploratory learning**, and requires students to actively engage a situation in order to find its solution.
- The science, engineering, and mathematics fields are made complete by the **technology** component that provides a **creative and innovative way to problem solve and apply** what has been learned.

Why base a Language Program on STEM?

- Content-based, cross-discipline with rich cultural component (World Language Standards, education)
- Age appropriate (psychology, pedagogy)
- Problem-solving, discovery and exploratory learning (Common Core State Standards, education)
- New and challenging domains of communication for heritage students (linguistics, heritage learners pedagogy)

STEM Component in UW STARTALK Russian Program



STEM units

- Space Exploration
- Voyage to Mars
- Airplanes



Role plays and labs at the Museum of Flight

- Voyage to Mars
- Be a pilot for a day



Interviews with professionals

- Boeing
- Microsoft

STEM Units

- **Space Race:** The History of Space Exploration
- **Voyage to Mars:** Be Prepared for a Role Play at the Museum of Flight
- **Airplanes:** Aviation History, Construction, and Aerodynamics

A set of postage stamps about USSR Space Exploration



[http://ru.wikipedia.org/wiki/Файл:Put k zvezdam prokladyvayut kommunisty blok 1964.jpg](http://ru.wikipedia.org/wiki/Файл:Put_k_zvezdam_prokladyvayut_kommunisty_blok_1964.jpg)

The Set of Postage Stamps:

Student Activities

- Before-lesson assignment: Discuss with Russian speakers (friends, relatives) what these stamps are about (Communication: Interpretive and Interpersonal)
- In the beginning of the lesson “Space Race,” students share with classmates (orally present) what they found out (Communication: Presentational)
- Using stamps, teacher illustrates and introduces specific vocabulary and structures students need to understand and use to describe Space Race events, such as спутник, космический корабль, космическая станция, выйти на орбиту, достигнуть орбиты etc. (Communication: Interpretive)

Create a timeline: *Student Activities*


- Students work in groups: read, find essential information in the articles (Who, when, where?), discuss this information in groups, and prepare brief oral presentation;
- Orally present the essential information from the articles (Who, when, where?) about Space Exploration;
- Create a timeline: make some notes (dates) on the whiteboard, place pictures of spacecraft and astronauts;
- Observe timeline and compare visual material from websites (an American site) to see the difference between Russian and American points of view on the Space Race.

Student Activities: Create a timeline, make some notes (dates) on the whiteboard, place pictures of spacecraft and astronauts



Student Activities:

Observe timeline and compare visual material from websites to see the difference between Russian and American points of view on the Space Race



The screenshot shows the website THE SPACERACE.COM with a header image of Earth and the Moon. The main content is a "Timeline of Space Exploration" listing events from 1957 to 1960. The events are color-coded by country: red for the USSR and blue for the USA. The left sidebar contains navigation menus for Primary Links, Forum, and Encyclopedia.

Year	Country	Event
1957	USSR	Oct. 4 - USSR launches Sputnik 1.
	USSR	Nov. 3 - USSR launches Sputnik 2 which carried a small dog named Laika into orbit.
1958	USA	Jan. 31 - Explorer 1, the first American satellite to reach orbit, is launched. It carried scientific equipment that led to the discovery of the Van Allen radiation belt.
	USA	Mar. 5 - Explorer 2 is launched but it fails to reach orbit.
	USA	Mar. 17 - The Vanguard 1 satellite is launched. It continues to function for 3 years.
	USSR	May 15 - Sputnik 3 is launched.
	USA	Oct. 1 - The National Aeronautics and Space Administration (NASA) is formed. It replaces the National Advisory Committee on Aeronautics (NACA).
	USA	Oct. 11 - Pioneer 1 is launched to a height of 70,700 miles.
1959	USSR	Jan. 2 - Luna 1 is launched by the USSR. It is the first man-made object to orbit the Sun.
	USA	Mar. 3 - Pioneer 4 is launched on a Earth-Moon trajectory. It passed within 37,000 miles of the Moon before falling into a solar orbit.
	USA	Apr. 2 - The "Mercury Seven" astronauts are selected by NASA.
	USSR	Sep. 12 - Luna 2 is launched. It impacts the Moon on September 13, becoming the first man-made object to do so.
	USSR	Oct. 4 - Luna 3 orbits the Moon and photographs 70% of its surface.
1960	USA	Apr. 1 - Tiros 1, the first successful weather satellite, is launched.
	USA	Aug. 18 - The US launches Discoverer XIV, its first camera equipped spy satellite.
	USA	Nov. 8 - John F. Kennedy is elected the 35th President of the United States.

- <http://www.thespacerace.com/timeline/>

Voyage to Mars Unit: Standards and Expected Outcomes

- Read and understand texts about Mars in Russian, including technical instructions during “Voyage to Mars” simulation (Communication: Interpretive);
- Briefly present orally, ask questions and understand answers about Mars exploration (Communication: Interpersonal);
- Review a list of job descriptions for the Mars team, scan for essential information in authentic texts (Communication: Interpretive);
- Describe people, jobs, places, planets, actions and emotions in oral form using appropriate grammar and vocabulary (Communication: Presentational);
- Develop brief written notes, rough draft, and final version of an essay (Communication: Presentational);
- Express orally and in written form post-activity Voyage to Mars feelings and experiences (Communication: Presentational).

Student Activities:

Исследуем Марс

- В полет на Марс я бы взял...



- Если бы я полетел на Марс, я бы исследовал...

- Я знаю, что на Марсе есть...

- Путешествие на Марс трудно, потому что...

Voyage to Mars Simulation at the Museum of Flight

- Introduction of specific vocabulary and structures students need to understand and use to complete the simulation
- Role-play communication during flight simulation
- Post-activities reflection



Student Activities: In Mission Control



Student Activities: **In the Spacecraft**



Airplanes Unit: Standards and Expected Outcomes

- Read, listen to and understand a variety of different texts including articles, bios, and technical instructions (Communication: Interpretive);
- Follow routes (with text markings in Russian) on a map for tracking a route of flight (Communication: Interpretive);
- Recognize the same Latin and Greek roots in both English and Russian science terminology (Comparisons) ;
- Fill in charts for a comparative analysis of airplane specifications (Communication: Interpretive);
- Write essays related to airplane topics with elements of description, evaluation and explanation (Communication: Presentational);
- Understand basic physics of airplane aerodynamics (Connections);
- Use their knowledge of geography to understand a flight route (Connections);
- Use and develop understanding of basic Russian cultural and historical context of XX century (Cultures).

Student Activities:

Предполетный осмотр

Основные части самолета Cirrus SR-20



Student Activities: **Pre-Flight Check**



Student Activities: Navigation



Основные аэродинамические силы, действующие на самолет в полете

- Подъемная сила (Lift, C_l)
- Сила сопротивления (Drag, C_d)



Student Activities:

Wind Tunnel Lab at the Museum of Flight



Interviews with Professionals



Interviews with Professionals

- Computer Programmer (Microsoft)
 - Research Engineer (Boeing)
 - Production Engineer (Airplane Production Plant)
- 1. Sharing their work and life experiences in Russian with the students**
 - 2. Inspiring students towards Russian language and STEM**

Interviews with Professionals

- Real-life tasks
 - Language: preparing students for interviews as a complex genre of communication;
 - Combining Russian language and culture teaching with STEM will better prepare the students for college and careers to succeed in the 21 century job market.



Interviews with Professionals:

- Structural and pedagogical approach
- Before the interviews: a lesson about “How to conduct a successful interview?” (lesson plans available)
 - You have to prepare for an interview (do research about your guest, a mini-biography of the first speaker)
 - It is a good idea to introduce your guest (idiomatic expressions of how to formally introduce a person)
 - Prepare interesting questions
 - Thank your guest verbally after the interview (idiomatic expressions of how to formally thank a person)
 - Send your guest a thank-you-note (step-by-step writing a thank-you-letter)

Interviews with Professionals:

- Organization:

Date	Time	Name	Profession	Instructor
7/26	11am-12pm	Nikolai Smolyanskiy	Computer Engineer (Microsoft)	Svetlana
7/31	1pm-2pm	Dmitriy Kamenetskiy	Research Engineer (Boeing)	Galina
8/2	11am-12pm	Vitaliy Gurevich	Production Engineer (Aviation Plant)	Lena

Interviews with Professionals: Standards and Expected Outcomes

- Meet, greet and introduce people in formal and informal settings (Communication: Interpersonal);
- Begin to use formal language style in discussing STEM topics with peers and a guest speaker (Communication: Interpersonal);
- Ask questions and understand answers about STEM topics (Communication: Interpersonal);
- Listen to and understand oral presentation about STEM topics (Communication: Interpretive);
- Recognize differences in Russian and American educational approaches for studying scientific disciplines through interviews with Russian professionals (Culture, Comparisons);
- Express post-activity feelings and experiences in short reflections using Moodle and thank-you letters (Communication: Presentational).

Step-by-Step Writing Process

1

- After the Museum of Flight simulations and interviews, the students talked about their roles/jobs, their activities, findings and feelings.

2

- They took brief written notes, based on which they then developed rough drafts and final versions for the written essay about their experiences.

3

- The students peer edited rough drafts and final versions of the essays.

Student Activities:

Writing

Сочинение №3. Самолеты: лучше, выше, быстрее!

Вы представитель авиакомпании и Ваша задача выбрать для покупки самолет, который лучше всего подходит для одной из следующих целей:

- 1) для пассажирских перевозок;
- 2) для перевозок грузов и почты;
- 3) для президентского самолета.

Выберите один самолет, сравните его с остальными и докажите, что он лучше всего подходит для Вашей цели.

Тип текста – доказательство на основе сравнения, сопоставления параметров двух объектов.

Самолет	Конкорд	Боинг 747-100	ИЛ-96-300	Боинг 787-3
				
Фюзеляж		двухпалубный широкофюзеляжный	широкофюзеляжный	широкофюзеляжный
Экипаж, чел.	3	3	3	
Длина, м	61,66	70,6 м	55,345 м	55,5 м
Высота, м	12,2	19,3 м	17,55 м	16,5 м
Размах крыла, м	25,60	59,6 м	57,66 м	51,6 м

UW STARTALK Russian Program and Communities

- Interviews with professionals
 - Strong connection with the community
- Collaboration with the Museum of Flight
 - Example of effective and enriching use of local resources in an educational program

You Can See and Use Our STEM Materials

- Program and lesson plans
- Scenarios and texts
- PowerPoint presentations
- Videos of the lessons
- UW STARTALK website

<https://depts.washington.edu/startalk/russianstudentresources.php>

Thank You!

- Спасибо за внимание!
- Вопросы?

