A U.S. AND JAPANESE STUDENT OUTLOOK ON THE IMPACT OF INTERNATIONAL RESEARCH INTERNSHIPS

#### **3RD INTERNATIONAL SYMPOSIUM ON TERAHERTZ NANOSCIENCE (TERANANO III)**

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# Topics

- Comparison of education abroad in the U.S. & Japan
- International research program overview
- Impact of international research internships
- Implications







### Study Abroad: US

#### I. U.S. STUDY ABROAD TRENDS

273,996 U.S. students studied abroad for academic credit in 2010/11, an increase of 1.3% over the previous year. U.S. student participation in study abroad has more than tripled over the past two decades.





## U.S. Study Abroad: Top Destinations as reported by *Open Doors 2012*

Rank	Destination	2009/10	2010/11	% of Total	% Change
	WORLD TOTAL	270,604	273,996	100	1.3
1	United Kingdom	32,683	33,182	12.1	1.5
2	Italy	27,940	30,361	11.1	8.7
3	Spain	25,411	25,965	9.5	2.2
4	France	17,161	17,019	6.2	-0.8
5	China	13,910	14,596	5.3	4.9
14	Japan	6,166	4,134	1.5	-33.0

*Top 20 study abroad destinations:* UK, Italy, Spain, France, China, Australia, Germany, Costa Rica, Ireland, India, Argentina, South Africa, Mexico, Japan, Brazil, Israel, Greece, Czech Republic, Chile, Ecuador



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#### U.S. Study Abroad: Fields of Study as Report by *Open Doors 2012*

Field of Study	2007/8	2008/9	2009/10	2010/11
Social Sciences	21.5	20.7	22.3	22.9
<b>Business &amp; Management</b>	20.2	19.5	20.8	20.5
Humanities	13.3	12.3	12.1	11.3
Fine or Applied Arts	8.4	7.3	8.3	8.2
Physical or Life Sciences	7.2	7.3	7.5	7.9
Foreign Languages	6.2	6.1	5.8	5.6
Health Professions	4.5	4.5	4.7	5.3
Education	4.1	4	4.1	4.2
Engineering	3.1	3.2	3.9	3.5
Math or Computer Science	1.6	1.6	1.5	1.8
Agriculture	1.2	1.1	1.3	1.3
Undeclared	3.3	3.5	4.5	2.7
Other	5.4	8.9	3.2	4.8
Total students	262,416	260,327	270,604	273,996

# Duration of U.S. Study Abroad

Duration	2007/8	2008/9	2009/10	2010/11
Short-term <i>Summer or 8 weeks or less</i>	56.3%	54.6%	56.6%	58.1%
Mid-Length 1 or 2 quarters or one semester	39.5%	41.1%	39.4%	38.0%
Long-Term <i>Academic or calendar year</i>	4.2%	4.3%	3.9%	3.9%

Source: Institute of International Education. (2012). "Fast Facts: 2012. ", "Fast Facts: 2011", and "Fast Facts: 2010", *Open Doors Report on International Educational Exchange*. Retrieved from http://www.iie.org/Research-and-Publications/Open-Doors/Data/Fast-Facts



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#### International Student Enrollment at U.S. Universities as reported in Open Doors 2012



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## Top Study Abroad Destinations for Japanese Students as reported by MEXT

-O-US -O-China -O-UK -O-Australia -O-Germany





#### Research articles with international coauthors, by selected region/country/economy: 1989–2009



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# Major Initiatives: U.S

• 100,000 Strong Initiative





 NAFSA Association of International Educators: Simon Award for Campus Internationalization



IIE Heiskell Award for
 Innovation in International
 Education

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# Major Initiatives: U.S



#### National Academy of Engineering "Infusing Real World Experience Into Engineering Education" Report

 "This nation's prosperity, security, and quality of life are direct results of leadership in the engineering achievements that drive society forward," said Dr. Charles M. Vest, president of the National Academy of Engineering. "These programs are strategically preparing students to become the engineers who will tackle the technical and social complexities that lie ahead in the 21st century."



#### **NSF Office of International Science & Education (OISE)**

- NSF Strategic Plan, Performance Goal #3: "Keep the United States globally competitive at the frontiers of knowledge by increasing international partnerships and collaborations."
- "The nation's commitment to research will...take on a more globally connected context as the major issues and problems we face know no boundaries."
   ~ Dr. Subra Suresh, NSF Director

# Major Initiatives: Japan







#### **"GLOBAL 30" PROJECT**

• Enhancement of capability of universities to welcome more international students

#### **"GLOBAL 30 PLUS": Human Resources**

• Enhancement of universities' efforts to encourage Japanese students to study abroad

#### **"RE-INVENTING JAPAN PROJECT"**

• Support development of exchange programs between universities that conduct cooperative education with overseas universities to implement mutual credit recognition and grade evaluation managements through a global quality-assured framework.

#### Bi-lateral Exchange

- Comprehensive information provision and overseas support
- Scholarships for International Students
- Promotion of overseas study by Japanese students









# **Profiled International Research Programs**

#### • NanoJapan: International Research Experience for Undergraduates

- Funded by NSF PIRE Grant. Administered by Rice & Tulsa
- Nationally competitive, typically 80 100 applications per year
- 106 U.S. students since 2006

#### Core-to-Core Program (Reverse NanoJapan)

- Administered by Osaka University
- Nominated by PIRE Japanese research advisor, timing and length varies
- 28 internships since 2011, including 25 co-funded by PIRE for 2011 Reverse NanoJapan

#### Hokkaido Center for Engineering Education & Development

- Administered by Hokkaido University, some gov't funding
- o Internal application, timing and length varies
- 33 students since 2008
- Self-Funded Students
  - 2 undergraduates from Chiba University
  - No application, timing and length varies



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# Profile of 106 NanoJapan Alumni

#### • Selection Rate: 20.3%

- Applications: 521
- Participants: 106

#### • Gender

Female: 37 (34.9%)
Male: 69 (65%)

#### Status

- Freshman: 34
- Sophomore: 55

#### • Home Universities

- Students from any university can apply
- 37 U.S. universities and colleges represented to date
- 1 Historically Black College or University
- o 3 Community Colleges

RICE









## **Profile of 57 Japanese Students**

#### • Gender

- Female: 6 (10.5%)
- Male: 51 (89.5%)

#### • Home University

- o Chiba University: 5
- Hokkaido University: 32
- Keio University: 3
- Osaka Inst. of Tech.: 1
- o Osaka University: 3
- Osaka U/RIKEN: 3
- o Tohoku University: 6
- Tokyo Tech: 1
- University of Tokyo: 3



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Status at time of internship

- B1:1
- B3: 3
- B4: 3
- M1: 27
- M2: 7
- D1: 4
- D2:6
- D3: 3
- Post-Doc: 3

### **Research questions**

- What do US and Japanese students perceive as the value of an international research experience?
- How do US and Japanese students perceive the value of an international research experience on their career or graduate school choices?





# Methods

- PIRE participant questionnaire
  - US students, since 2008
  - o Japanese students, October 2012
- Qualitative questions
- Ranking, Reported benefits from international experience



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### Participants: Japanese respondents (N=34)

#### Self-Reported English Language Skills



You can converse in any condition (over the phone in particular) over any topic. You make jokes, use idiomatic expressions and can convey your thought with all the subtleties and distinctions that you want.

No problem to speak with people, you can speak about most topics without feeling constrained. Here and there, you miss some words, but you can usually explain them by another way or ask what they are by giving their definitions.

You can tell people what you need without too much trouble, and you can express basic judgments or give sensible answers when asked. Nevertheless, you have to stretch your vocabulary to achieve this and you use periphrases heavily.

You can explain what you need in live very basically, with the use of gesture. Expressing opinions and answering beyond yes or no is very limited.











# Participants: US Respondents (N=64)

#### **Status**

- o 28 Freshman
- 32 Sophomores
- o 4 Juniors

### • Gender

- o 27 female
- o 37 Male

#### Majors

- Bioengineering- 9
- Chemical engineering 5
- Chemistry -4
- o Civil engineering-1
- Electrical engineering-18
- Materials science -5
- Mechanical engineering -5
- Nanotechnology -2
- $\circ$  Physics -15











### **Participants: US Respondents (N=64)** Self-reported level of Japanese, beginning NanoJapan 60 50 40 30 20 10 0 Intermediate None Advanced Partnerships for International Research and Education

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# International dimension of the research project was an important factor in my decision to join the project.



# I am confident that I can be a valuable part of an international research collaboration.



### Personal Development/ Confidence: Japanese Students

- I hope so. The problem is that I am not confident in myself enough to push "Strong Agree" in all questions. This is my personality. What is difference to be confident in myself and to brag myself?
- I think that the importance of multilateral collaboration research has increased and my experience of being a part of this collaboration leads to develop my confidence as a researcher even though it was short
- The experience of research in the U.S. increased my confidence to continue my research.
- It took a lot of courage for me to go to other countries with different language and culture for research.
- I am not afraid to speak English anymore
- In Japan, studying abroad has big meaning and the person studied abroad is recognized for its challenge spirit. The experience at Rice influenced a lot when I decided what I should do with my life.
  - I gained some ideas. I have more patience.

### Personal Development/ Confidence: US Students

- Taught me not to fear cultural and language barriers in science, which I then used to do an internship in Brazil the following summer.
- Significantly increased my confidence as a researcher and my interest in carbon nanostructures and their vast applications. ... The program also considerably improved my Japanese speaking confidence, and my confidence as a leader.
- Research is my main career focus, so the fact that I have had the experience of relocating to a different culture and lab environment and successfully adapting to it means that I have greatly increased comfort and confidence in research environments. After all, relocating to a different lab in the U.S. will always pale in comparison to relocating to a lab on the other side of the world.



#### **Cross-cultural differences: Japanese responses**

- Since I had a lot of chances to communicate with other students working in the same laboratory, I had been able to express my opinion clearly. I also got used to American straightforward expression instead of Japanese vague expressions.
- Cultural context affects not only science but also everything
- Through this internship, I learned that there were various ways to approach a problem as much as variety of races, cultures, and languages. I could proceed with my research by having many discussions (although sometimes I was wrong)
- But as for communication with foreign professor, I could not stop bowing when I met him there instead of just saying hello. My research experience did not expel my feudalism in me.

### **Cross Cultural Differences: US Responses**

- Being a NanoJapan alumnus means becoming someone who is sensitive and adaptable to different cultures in a professional or academic environment. Which is a pretty useful skill to have in today's multicultural economy, in almost every industry.
- Not only did I gain a great deal of practical knowledge from my Japanese lab, but I experienced how much research can bring people from varying backgrounds and cultures together.
- The might seem strange, but I am now far more involved with American culture than I was before. I used to never go to football games here at LSU, and I avoided all of the festive atmosphere like the plague. While I can not bring myself to spend money to go to the loudest stadium in the country (can't stand loud noises), I have started going to tailgates and appreciating the bits of culture everywhere.

# I am flexible and cope well with new challenges as I conduct research.



### **Flexibility: Japanese Students**

- I am a flexible person regardless of research.
- I could experience many projects in the laboratory and it helped me to develop an ability to cope well with new challenges
- My research project has been changed 4 times. (5 projects if I include this internship)
- I could have confidence by researching in a different field from mine at Rice.

### **Flexibility: US Students**

- Academic: Through NJ, I learned how interdisciplinary research can be. My project ended up spanning a wide variety of topics including math, physics, and chemistry
- Through my hands-on research and conversations with the members of my NanoJapan lab, I knew when I applied to graduate school that I would face many obstacles: Unpredictable and long hours No guarantee of (forward)
   progress as a function of time spent in the lab That
   progress often means analyzing your test results and
   discovering that what you have spent a great deal of time on
   is not a viable solution Not to be pessimistic obviously
   there were lots of good experiences, or I would not be in
   graduate school!

#### I am likely to pursue (or remain) in a career in a science or engineering field.



### **Career preparation: Japanese Students**

- The internship made me decide to go on to doctoral course.
- I found the fun of research.
- I joined this research internship when I was M-1.At that time; I planned to work in private sector after I finish my master courses in Japan. However, now I'm studying in the U.S. graduate school to get a doctoral degree
- My career and academic background is not related. However, through my internship, I started to think about working abroad and actually I chose a company sending a lot of employees abroad.
- I can write "I was working in U.S." in my CV. But it may not give impact on my career goal very much.
- I had been able to express my intentions without hesitation. It is an advantage in my job.

### **Career Preparation: US Students**

- Looking back now, I see that my lab in NanoJapan gave me a realistic taste of graduate school life (the good AND the bad) that many students lack when they apply for graduate school. I know more than a few people that have left their graduate programs because research was not what they expected. Many of these people had performed research during their undergraduate studies as well, which speaks to the accuracy of the NanoJapan experience in particular.
- Without realizing it at the time, NanoJapan served as one of the most transformative experiences in my life the introduction to magnetism and spin-related research that eventually led me to pursue a PhD in magnetics, the beginning proficiency in the Japanese language that I continue to learn, and the experience of a deeply respectful culture and meticulously clean country that I hope to return to someday. Although at the time, I did not fully understand the depth of Takaaki Koga-sensei's research into the spin properties of semiconductors, the introduction to the concepts and terminology of spin, quantum wells, etc. became important as it later came up again as the fundamental basis of my studies and research into magnetism.
- Career: NJ cemented my decision to pursue a phd because I really enjoyed interacting with other students.



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# Foreign collaborators can provide valuable contributions to (U.S./Japanese) science projects



### **Network: Japanese Students**

- I believe that the relationship with people I met through my internship and the stimulus from them would be really useful for my research activities and job recruitments.
- I feel that the experience is useful for my present job having many international collaborative researches.
- It's important to combine one's respective realms of expertise for success in a collaborative research. I think that I could make use of my knowledge and skills in my internship.
- I've built connection with people working on nanotech around the world.

### **Network: US Students**

- There also is the factor of what an amazing experience it is to discuss with other researchers. Most people are extremely curious about the program when I discuss it with them, as well as what my individual experience was like. Whether it is at a conference, or in interviews, I have found everyone whats to hear more about my summer. Most people are lucky to work in a lab overseas at some point in their career so it is always surprising when I mention I worked in one during my undergraduate years.
- Furthermore, through the NanoJapan program, I gained a valuable network of friends (my fellow participants) and professional relationships (e.g. Professors, visiting Student Researchers).
- I was able to make several very close friends who I am still am in contact with today, and I look forward to taking advantage of the first opportunity for continued collaboration with Japanese researchers that presents itself in the context of my current research.

#### The cultural context of science has an impact on how the research is conducted.



### Comparison of U.S. & Japanese Research: Japanese Students

- I thought that people in the U.S. tell their opinion more clearly than Japanese people do and they have very active debate in research. I thought that I should tell others my opinion and what I think.
- It is our benefit to listen to other opinions by different countries and cultures. Also, U.S. people's plain-speaking stimulate Japanese people who are not good at it.
- Japanese researchers are good at detailed work and very professional knowledge, but some people are lack the ability to look at the big picture.
- I felt that, in the U.S., there was active discussion with other laboratories or researchers compared to Japan. It's nice to fill the gap in research by giving advices to other researchers, not only by renting research equipments
- I could understand the difference in way of doing researches. From the experience, I could find the good thing and bad thing in Japanese research style.
- A nationality does not matter.



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### Comparison of U.S. & Japanese Research: US Students

- My approach to research and collaborations has broadened from these experiences, as I understand scientific research to be a global effort and not just work done in specific labs.
- Not only did I gain a great deal of practical knowledge from my Japanese lab, but I experienced how much research can bring people from varying backgrounds and cultures together.
- It makes me understand the Japanese academic and cultural environment a little more. I would highly consider to conduct research in Japan or forming a potential collaboration in research in the future.
- [NanoJapan] helped me enormously in understanding how scientific collaborations, especially international ones, work on a day to day basis.



### Rank order, Benefits from International Research Experience

#### Japanese students: N-27; US Students: N=19

#### **U.S. Students**

- **1.** Exposure to new research areas, equipment, techniques
- Opportunity to learn more about Japan in general
- 3. Increased confidence as a researcher
- **4.** Increased flexibility to deal with research challenges
- 5. Wider professional network
- **6.** Preparation to apply to graduate school
- **7.** Improved ability to speak Japanese
- 8. Greater career focus
- **9.** Understanding of the differences in how research is conducted in the US and Japan
- **10.** An experience that will be valued by employers

#### **Japanese Students**

- **1.** Exposure to new research areas, equipment, techniques
- **2.** Increased flexibility to deal with research challenges
- **3.** Greater career focus
- **4.** Improved ability to speak English
- **5.** Wider professional network
- **6.** Opportunity to learn more about the US in general
- **7.** Understanding of the differences in how research is conducted in the US and Japan
- **8.** Increased confidence as a researcher
- **9.** An experience that will be valued by employers
- **10.** Preparation to apply to graduate school

### Conclusions

- U.S. respondents are more highly motivated by the international aspect of research than Japanese students
- U.S. and Japanese students are highly motivated by exposure to new research, equipment, and techniques
- Japanese students place priority on the flexibility and self-confidence they develop from the international experience. This ranks higher than improvements in English language abilities.

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• U.S. respondents are more interested in Japanese culture (in general) than Japanese language.



### Conclusions

- U.S. and Japanese students similarly value an international professional network. U.S. students include peers who researched in Japan as part of their network.
- U.S. students consider their international research an asset when applying to graduate school.
- The Japanese students do not indicate the shortterm international experience itself will be an asset for academic careers in Japan. Students who seek industry positions report some benefit.







# Conclusions

- US students demonstrate higher levels of selfconfidence in their responses than Japanese students.
- Japanese students value the international experience for its intrinsic benefits. US students perceive the international experience as an intrinsic and extrinsic benefit.