

## Original article

# Japanese undergraduate students' perceptions of prosthetics and orthotics education

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Key words: prosthetics and orthotics, education, Japan

Received: 20 July 2018/Accepted: 26 September 2018

### Abstract

Only a few universities and colleges offer prosthetics and orthotics education worldwide. As of 2017, World Health Organization and the International Society of Prosthetics and Orthotics have established the standard of the prosthetics and orthotics profession. Investigating the status of the prosthetics and orthotics education in one of the high-income countries in the world will highlight an insight of the profession. This study reports on the current status of prosthetics and orthotics education on the undergraduate level in Japan. A survey was conducted among the universities and colleges offering prosthetics and orthotics programs in Japan. A total of 136 students with mean age of 21 years from 6 schools responded to the survey. Of the total number of the respondents 50 (37%) were freshmen, 41 (30%) sophomores, 23 (17%) juniors and 22 (16%) seniors. The results highlighted some difficulties mainly related to biomechanics course, upper and lower limbs prosthetic manufacturing. Understanding an update of the prosthetics and orthotics education programs in the developed countries enables some

clues for strategic planning to develop teaching methods that improve the professional skills of the students.

### Introduction

Advances in the field of health sciences with innovative approach led to improved quality of life of the patients all over the world. According to WHO only 1 of 10 in need has access to assistive products, including prostheses and orthoses services. More transformative training and education are required to address the need globally [1]. The number of trained personnel is still far away from the requirements in low-and middle-income countries, especially in Africa [2, 3]. Investigating some insights of the field in one of the developed countries such as Japan for comparison is essential. The elderly population in Japan has been increasing year by year. Thus the supporting staff of care providers also is in a high demand including those in the rehabilitative field. Various universities and colleges offer courses for prosthetics and orthotics and Assistive Technology. Some challenges were reported in former studies

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regarding prosthetics and orthotics education in Japan [4, 5]. These studies investigated the prosthetics and orthotics needs or trends in the country. However these studies only surveyed the professionals in the prosthetics and orthotics field. To understand the issue from the point of view of educational level, students' perceptions need to be analyzed in detail.

The education in prosthetics and orthotics in Japan started about three decades as in 2018. As of 2018, four universities and seven professional training colleges offer Prosthetics and Orthotics degree in Japan. Undergraduate students are given the "Certified Prosthetist and Orthotist" certificate upon passing the National License Examination. The International Society of Prosthetics and Orthotics (ISPO) has classified the prosthetics and orthotics education programs into three categories: Category I (Prosthetist Orthotist), Category II (Associate Prosthetist Orthotist) and Category III (Prosthetic Orthotic Technician). The Category I sample curriculum (Table 1) is University entry level with 3/4 years formal structured Training

leading to Bachelor Degree [6].

The purpose of this study is to explore the current status of prosthetics and orthotics education in Japan from the undergraduate student's perceptions. The results reflect on the current prosthetics and orthotics education system in Japan.

### Materials and Methods

The questionnaire was designed based on similar studies done in other countries [2, 3]. One of the authors is a Japanese National bilingual researcher and has validated the Japanese version of the questionnaire. The English and Japanese version of the questionnaire were first sent to the Japanese Academy of Prosthetists and Orthotists (JAPO) administration for approval. Then JAPO sent the Japanese version of the questionnaire to the head and representative of 11 Universities and colleges to be transmitted to the students enrolled in the prosthetics and orthotics program in October 2017. The questionnaire was in Japanese language to ensure that the questions were clear and easily

Table 1. Organisation of Category I subjects.

ISPO Category I subjects course
<b>CORE SUBJECTS</b>
Practical
Prosthetics and Orthotics Science – Practical
Clinical Practice
Theoretical
Prosthetics and Orthotics Science – Theory
Anatomy and Physiology
Pathology
Mechanics and Biomechanics
Clinical Studies
Materials Technology
<b>SECONDARY SUBJECTS</b>
Clinic, Workshop and Business Management
Workshop Technology
Electro Technology
Research Methods in Health

understood by the respondents. As of 2018 there are about one thousand students enrolled in these schools and about 350 students graduate every year.

Minor revisions were done in light of suggestions received. A 13-item questionnaire was finalized for data collection. The participants were requested to complete the survey through a specified Google form. Completed surveys were sent from the web-server directly to the investigator mail for analysis. The data were collected through October to Mid-November 2017.

The purpose of the study was clearly stated at the beginning of the web based questionnaire and the respondents were free to answer at any time. In order to get some insights about the prosthetics and orthotics education in this technology, the survey consisted of the student's plan after graduation, and the difficulties found during training and graduation projects.

This study was approved by the Ethics Committee of the Niigata University of Health and Welfare (Approval No: 17866). Collected data were analyzed using descriptive statistics.

## Results

One hundred and thirty-six students from 6 schools completed the survey. Among the respondents with mean age of 21 years, 83 (61%) were males while 53 (39%) were females. A breakdown of the respondents by grade was as follows: 50 (37%) were freshmen, 41 (30%) sophomores, 23 (17%) juniors and 22 (16%) seniors. The demographic information of the respondents was reported in Table 2 and Table 3 describes the main results of the survey. The majority of the respondents were (99.3%) Japanese nationals. Over half of the respondents (63.2%) reported to work in prosthetics and orthotics industries after graduating from their Universities. A large number of the respondents found difficulties in biomechanics course (65.4%), lower limb prostheses (47.8%) and upper limb prostheses (47.1%). In terms of the topic of research field, there was some diversity on the graduation projects. And also 39 (28.7%) of the respondents reported some difficulties in investigation methods and 37 (27.2%) of them in writing reports and papers.

Table 2. Demographic information.

	Number (n = 136)	%
Sex		
Male	83	61%
Female	53	39%
Age (years)		
Mean	21	
Grade		
Freshman	50	37%
Sophomore	41	30%
Junior	23	17%
Senior	22	16%
Nationalities		
Japan	135	99.3%
Other	1	0.7%

Table 3. Characteristics of the respondents.

	Number (n = 136)	%
Plan after graduation		
Go for graduate school in P and O	3	2.2%
Work at P and O industry	86	63.2%
Not yet decided	47	34.6%
Difficulties found during training		
Upper limb prostheses	64	47.1%
Lower limb prostheses	65	47.8%
Upper limb orthoses	42	30.9%
Lower limb orthoses	51	37.5%
Spinal brace	43	31.6%
Biomechanics	89	65.4%
Access to motion capture system		
Yes	46	33.8%
No	86	63.2%
Access to biomechanics books and articles in school library		
Yes	51	37.5%
No	81	59.5%
Member of professional organizations		
Japanese Academy of Prosthetics and Orthotics	86	63.2%
Japanese Society of Prosthetics and Orthotics	31	22.8%
International Society of Prosthetics and Orthotics	1	0.7%
Participation in Conference/ Seminar in P and O		
None	66	48.5%
Once	36	26.5%
Twice	18	13.2%
Three times and more	14	10.3%
Topic of research field	23	16.9%
Upper limb prostheses		
Lower limb prostheses	43	31.6%
Upper limb orthoses	14	10.3%
Lower limb orthoses	46	33.8%
Spinal brace	25	18.4%
Shoe	43	31.6%
Wheelchair/ seating	24	17.6%
Motion analysis/ Biomechanics	30	22%
Difficulties found in graduation projects work		
Subject selection and request	24	17.6%
Knowledge about measurements/ investigation methods	39	28.7%
Statistical method	28	20.1%
Presentation technique	20	14.7%
Writing reports/ papers	37	27.2%
Interaction with seminar faculty	10	7.3%
Research funds	11	8.1%

## Discussion

This study reported on the current status of the prosthetics and orthotics and students' perceptions on education. This research was the first attempt to investigate the prosthetics and orthotics education in Japan after three decades of prosthetics and orthotics degree program has been established. Japan has a wide range of prosthetics and orthotics industries across the country to meet the job requirement of the annual average of 350 graduates. That was the reason behind the low rate of students continuing to the graduate program after their first degree 3 (2.2%). While in other prosthetics and orthotics educational program, graduates had a strong desire to upgrade to master and doctoral level in the field [2, 3].

The demand in number of prosthetics and orthotics technicians worldwide is very considerate according to the WHO and ISPO [1]. Therefore training a number of technicians to meet the world's needs is important. Japan has quite a huge number of enrolled students in prosthetics and orthotics program compared to United States of America [7], England [8] and other programs in Africa [2, 3]. The prosthetics and orthotics degree program in some universities (case of Niigata University of Health and Welfare) in Japan has included the assistive products consultant, assistive products planner, housing environment coordinator for elderly and disabled people. Japan has a high rate of elderly population, it is highly important for prosthetics and orthotics professionals to acquire knowledge of assistive products and housing environment.

This study revealed the perceptions of students enrolled in the prosthetics and orthotics course. However, some difficulties related to biomechanics course, upper/lower limbs prostheses manufacturing and writing graduation project reports have also been reported by some students (Table 3). Those difficulties in the biomechanics course were not exclusive to this particular study. This result was consistent with

our previous studies [2, 3]. Magnusson et al [9, 10] also reported some difficulties in biomechanics course in Pakistan, Tanzania and Malawi.

Our study however presents some limitations. This study described the current status of prosthetics and orthotics education in Japan, we did not take into consideration the graduate student's opinions. Also the majority of the respondents 50 (37%) were freshmen and might have some lack of experience when perceiving the difficulties found during their practical training. The sample size was small (136 respondents from 6 schools consisting of nearly one thousand students) in our study. Moreover, the curriculum of the various schools needed to be investigated for the consistency. Finally we did not survey the facilities and equipment of the prosthetics and orthotics program. This is because our study only surveyed perceptions of students in their course of study.

Some recommendations are therefore suggested:

The prosthetics and orthotics course is in high demand globally [1]. The response rate of the present survey is majority of Japanese nationals because the course are fully delivered in Japanese language that makes it difficult for international students to enroll [11]. In order to achieve a global influence, English for specific purposes has to be established in the program. Moreover the establishment of English version of local journal of prosthetics and orthotics in order to attract international professionals and students is needed. As of 2018, only one school in Japan has been accredited by ISPO [12]. Therefore other universities have to establish strategic plans to acquire ISPO accreditation. Further research on outcomes of the training and the workforce demands need to be explored.

## Conclusion

The findings of the present study were the first attempt to elucidate the current status of prosthetics and orthotics education program in

Japan as of 2018. Understanding the current status of prosthetics and orthotics education in one of the highly technological country enables some keys to develop teaching methods to improve the professional skills of the students.

### Acknowledgements

The authors would like to thank all the students who completed the survey and also we are grateful to Prof Kazuhiro Sakai of Japanese Academy of Prosthetists and Orthotists for his valuable help throughout the data collection.

### Conflicts of interest

There are no conflicts of interest to declare.

### References

1. WHO standards for prosthetics and orthotics. Geneva: World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO.
2. Aduayom-Ahego A, Ehara Y. Current position and challenges in prosthetics and orthotics education in Ghana. *Niigata Journal of Health and Welfare*. 2016; 16 (1):26-34.
3. Aduayom-Ahego A, Ehara Y, Kpandressi A. Challenges in prosthetics and orthotics education in sub-Saharan Africa francophone country Togo. *Ec Orthopaedics*. 2017; 6(6):230-237.
4. Sakai K. Current status and challenges of prosthetics and orthotics education in Japan. *Proceedings of the 53rd Annual Meeting of the Japanese Association of Rehabilitation Medicine*; 2016 June 9-11; Kyoto, Japan. S202.
5. Sakai K. Investigation of prosthetics and orthotics education in Japan. *Proceedings of 16th World Congress of International Society of Prosthetics and Orthotics*; 2017 May 8-11; Cape Town, South Africa; 31-32.
6. Category I professional – prosthetist/orthotist, orthopaedic engineer, orthopaedic meister. *International Society for Prosthetics and Orthotics*; 2001.  
[https://cdn.ymaws.com/www.ispoint.org/resource/resmgr/3\\_LEARN/Information\\_Package\\_Cat\\_1\\_Au.pdf](https://cdn.ymaws.com/www.ispoint.org/resource/resmgr/3_LEARN/Information_Package_Cat_1_Au.pdf). (accessed August 17, 2018)
7. Dearing RH, Kelly S, Minert D. Why educated technicians are critical to the future of O & P care and how your contribution matters. *The O & P Edge*; 2017.  
<https://opedge.com/Articles/ViewArticle/2017-06-21/why-educated-technicians-are-critical-to-the-future-of-op-care-and-how-your-contribution-matters>. (accessed March 16, 2018)
8. The future of the orthotic and prosthetic workforce in England. *Health Education England*; 2017.  
[https://hee.nhs.uk/sites/default/files/documents/Orthotic%20Report%20%20Final%20Version\\_0.pdf](https://hee.nhs.uk/sites/default/files/documents/Orthotic%20Report%20%20Final%20Version_0.pdf). (accessed August 19, 2018)
9. Magnusson L, Ramstrand N. Prosthetist/orthotist educational experience & professional development in Pakistan. *Disability and Rehabilitation: Assistive Technology*. 2009; 4(6):385-392.
10. Magnusson L, Shangali GH, Ahlström G. Graduates' perceptions of prosthetic and orthotic education and clinical practice in Tanzania and Malawi. *African Journal of Disability*, 2016; 5 (1): a142.
11. Niigata University of Health and Welfare; Admission Guide of Undergraduate Programs; 2018.  
<https://en.nuhw.ac.jp/admissions/admissions-us.html>. (accessed August 17, 2018)
12. Recognised schools and training programmes. *International Society for Prosthetics and Orthotics*; 2018.  
<https://www.ispoint.org/page/Programmes>. (accessed August 17, 2018)

## Appendix

### Questionnaire

Sex:

- Male
- Female

Age:

Nationality:

1. Why did you choose to be trained as Prosthetist/Orthotist?

2. University/College

- Hokkaido Institute of Technology
- Hokkaido High-Technology College
- Niigata University of Health and Welfare
- The College of National Rehabilitation Center for the Disabled
- Seibu Gakuen Bunri College of Nutrition and Medical Technology
- University of Human Arts and Sciences
- Japan College of Rehabilitation and Welfare Professionals
- Kobe College of Medical Welfare Sanda Campus (3 years Diploma)
- Kobe College of Medical Welfare Sanda Campus (4 Years Advanced Diploma)
- Hiroshima International University
- Kumamoto College of Medical Science and Social Welfare

3. School grade

- Freshman
- Sophomore
- Junior
- Senior

4. What is your plan after graduation?

- Go for graduate school in prosthetics and orthotics
- Work at prosthetic /orthotic centre
- Not yet decided

5. What are the difficulties do you find in the following areas?

- Upper limb prostheses
- Lower limb prostheses
- Upper limb orthoses
- Lower limb orthoses
- Spinal brace
- Biomechanics

6. Do you have access to motion analysis device (e.g. VICON) for biomechanical practical course?

- Yes
- No

7. Do you have access to books or articles of biomechanics in the school library?

a.

- Yes
- No

b. If yes how frequently do you read them?

- Every day
- Once a week
- Once a month
- Once a year

8. Do you belong to any prosthetics/orthotics organization?

- Japanese Academy of Prosthetists and Orthotists
- Japanese Society of Prosthetists and Orthotists
- International Society of Prosthetics and Orthotics
- Other

9. How frequently do you participate in prosthetics / orthotics conference or seminar annually?

- None
- Once
- Twice
- Three times and more



10. What is your area topic of research?

- Upper limb prostheses
- Lower limb prostheses
- Upper limb orthoses
- Lower limb orthoses
- Spinal Brace
- Shoe
- Wheelchair seating
- Assistive products
- Motion analysis/ Biomechanics
- Other

11. Please describe in a few words the content of your graduation project work. (Final year students only)

12. What are the difficulties do you find in doing your graduation project work? (Final year student only)

- Choosing the research topic
- Subject selection and request
- Knowledge about measurements or investigation methods
- Statistical method
- Presentation technique
- Writing reports and papers
- Interaction with seminar faculty
- Research funds
- Other

13. What is your general opinion about this survey?