

Utility of science, technology and innovation governance for occupational discourses from the perspective of occupational therapy students

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Abstract.

BACKGROUND: Science, technology and innovation (STI) governance concerns itself with the societal impact of STI. Occupation, whether used with the meaning of paid, unpaid work or any activity that is considered meaningful to the individual on an everyday basis, is one area of societal impact of STI. Fields such as occupational therapy, occupational science and occupational health and safety concern themselves with the relationship between occupation and the health and well-being of human beings albeit all with different foci.

OBJECTIVE: To ascertain the knowledge of students from two Occupational Therapy programs on STI governance, specific STI products and their views on the impact of STI governance and STI products on occupational therapy and its clients.

METHODS: Online survey employing Yes/No' questions with comment boxes and open-ended textbox questions. Descriptive quantitative and thematic qualitative data was generated.

RESULTS: Students were unfamiliar with STI governance discourses but felt that they should be aware of them. Students stated that how one governs STI impacts occupational therapy on all levels and that the occupational therapy community has expertise that would enrich STI governance discourses around occupation.

CONCLUSION: Education actions seem to be warranted on the level of students and practitioners by the occupational therapy and STI governance communities.

Keywords: Occupational therapy, governance, science, technology, innovation, human enhancement, robotics, brain machine interface, autonomous cars, students

1. Introduction

Scientific and technological innovations (STI) impact individuals and society as a whole. The societal landscape of occupation (paid, unpaid, leisure,

daily activity . . .) and humans as occupational beings [1–11] is one area of impact of STI. Recent STI advancements with occupational impact include robotics [3, 5, 12–18], autonomous cars [5, 19, 20], brain machine interfaces [21], and human enhancement [22–25].

Given the continuous impact of STI on individuals and society, it is not surprising that many discourses

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engage with how to deal with the impact of STI advancements. The discourses range from analyzing the utility of a certain STI product for individuals [26] to discussions around how to anticipate and deal with the societal impact of STI advancement (STI governance) [27–32]. STI governance is covered in discourses using terms such as democratizing science, technology and innovation [33–42], participatory technology assessment [43, 44], anticipatory governance [45–47] and responsible innovation [48, 49].

According to Irvin (2008) “the study of scientific governance is broadly concerned with the relationship between science, technology, and political power—with special emphasis on democratic engagement, the relationship between ‘scientific’ and wider social concerns, and the resolution of political conflict and controversy” [27].

Various fields such as occupational therapy, occupational science and occupational health and safety concern themselves with the relationship between the occupational landscape and humans as occupational beings, albeit all with different foci. As such the actions of members of these fields are impacted by STI advancements and how STI are governed.

Our study focuses on occupational therapy. Occupational therapy (OT) is responsible for enabling occupation and ensuring a “just and inclusive society where everyone can meaningful participate in daily occupations of life” [50]. Occupational Therapists use technologies in their work [51–58]. As such the practice of occupational therapy is impacted by STI advancements in general and STI governance in particular.

It is well recorded that Occupational Therapists are involved in the utility assessment of technologies such as assistive technologies for their clients [51, 52]. Indeed, when we performed a brief literature review using databases such as Scopus, which also includes all articles from Medline, and the 70 databases of EBSCO ALL as part of this study we found many articles that covered occupational therapy in relation to technology assessment on the individual level. However, the STI governance terms used to identify various discussions surrounding the governance of STI did not intersect with the term “occupational therapy” in the academic literature.

We posit that the occupational therapy community (students, educators, scholars, practitioners and clients) has a stake not only in individual utility of an STI advancement but also on the societal impact of STI and how STI are governed due to their impact on occupation. To better understand the literature find-

ings, we focused in our study to answer the following research questions: 1) What is the knowledge of students from two Occupational Therapy programs on: STI governance; specific STIs (robotics, autonomous cars, brain machine interface, human enhancement); 2) what is the view of the students on the impact of STI governance and STI products on occupational therapy as a field, occupational therapy clients and various occupational concepts and 3) what is the view of the students on the visibility of occupational therapy in governance discussions. As such, our study adds to the literature of occupation in general, occupational therapy in particular and STI governance and contributes to the goal of “research related to Occupational Therapy Education development” [59] and educating about STI governance.

1.1. Occupation and science technology innovation

Occupation is one area of societal impact of STI. STI constantly impact the landscape of occupation, whether they make certain occupations obsolete [1–5], generate new forms of occupation or change existing occupations. STI impact occupation of paid work, such as wage structure [60], wage distribution [61, 62], wage premiums [63], and wage level [64]. Moreover, STI impact employment structure [65], employment dynamics [66–68] and unemployment in developing countries [69]. STI also affect being occupied with housework [70] and the societal perception of housework as a valued occupation [71–74], with leisure [75] including high performance sport [76] and volunteering [77, 78] to just name a few areas.

Various fields such as occupational therapy, occupational science and occupational health and safety concern themselves with relationship between occupation and the health and wellbeing of human beings albeit all with different foci.

1.2. Occupational therapy: From individual assessment ...

According to the 2016 *World Federation of Occupational Therapists* document *EB139/4 Improving Access to Assistive Technology; report by the Secretariat* [79], “Occupational Therapists play an important role in the assessment for and provision of assistive products and as such are in a prominent position to help raise awareness about the need for assistive products including the training of personnel”. Occupational therapists provide assistive

technologies [51] in the form of the device itself or as a service linked to the assistive technology [54]. Both, high tech and low tech assistive technologies are of interest to the occupational therapy discourse [51–58]. Rapid technological change is being reflected in the practice of occupational therapy and is seen as important to the future of occupational therapists and clients alike [80, 81]. A survey of occupational therapists found that the best use of assistive technologies is achieved when taking into account the client’s acceptance of technology, their lifestyle and their goals [52]. This client-centered approach is seen to require occupational therapists to stay current with trends and changes in technology to appropriately address the client’s needs, taking into account the client, family members, and caregivers’ concerns, and funding of the technology [52]. The *Canadian Association of Occupational Therapists’ (CAOT) position statement on Assistive Technology and Occupational Therapy* [82] lists CAOT Initiatives to increase access to assistive technology, provides background material on the topic [82] and lists seven recommendations:

1. Implement a client-centered process that considers the interaction of the client, their occupations, and environments in the recommendation of assistive technology.
2. Educate Canadians on the benefits assistive technologies have in promoting health and well-being.
3. Promote the use and social acceptance of assistive technologies.
4. Advocate for access to, and funding for, all aspects of the assistive technology acquisition process, including assessment, purchase, training in device-use and follow-up, across all sectors and regions of Canadian society.
5. Be knowledgeable of the ethical use of assistive technology, particularly with regard to technology that has the potential to limit the client’s freedom (e.g., restraints, pervasive computing technology), and advocate for the ethical application of this technology, balancing the right of the client to independence with the need to enhance their safety.
6. Conduct and share results of research regarding the development of assistive technology and the evaluation of the outcome of assistive technology use in daily life.
7. Educate Canadians of their right to access environments, devices, and services under relevant legislation [82].

1.3. Occupational Therapy: ... to the evaluation of societal implications

There exists another growing aspect of STI assessment that operates on the societal level. It is displayed in evaluating how to govern STI so as to identify potential negative and positive societal implications and the actions required to address them [27–32, 83–91]. Many discourses exist around how to govern STI (see for example concepts such as democratizing science, technology and innovation [33–42], participatory technology assessment [43, 44], anticipatory governance [45–47] and responsible innovation [48, 49]). According to Porse (2012), “the term governance has been associated with science and technology to refer to an expanded network of influential actors and organizations that drive the development and uptake of science and technology through society, part of an enlarging view of the process of policy-making” [92]. In addition, Irvin (2008) argues that “the study of scientific governance is broadly concerned with the relationship between science, technology, and political power—with special emphasis on democratic engagement, the relationship between “scientific” and wider social concerns, and the resolution of political conflict and controversy” [27], (see also [27–32] for description of science and technology governance.

The state of knowledge of the public on a given STI is a recurring theme in discussions around the engagement of the public in the governance of STI [93–95]. Anticipatory governance, one discourse engaging with how we should govern STI, is based on the premise that actors from different fields such as social and natural sciences and from different backgrounds such as public citizens, developers, engineers, and policy-makers are engaged to produce a community of practice that engages with awareness, reaction, knowledge development and encourages the governance of societal impacts of science and technology [96–99]. It is seen as important that the societal discussions of science and technology advancements should be a constant endeavor [96, 100]. However, few studies engaged with the involvement of health professionals in STI governance discussions. One study highlighted a lack of involvement of health professions such as social work in discussions around science and technology governance and various emerging scientific and technological advancements [101]. Another indicated certain lack of skills:

“trainees from diverse healthcare professions (e.g., nursing, social work, physiotherapy) are not well prepared to handle many of the ethical issues associated with psychiatric DBS because, among other reasons, they may be unprepared to engage in ethical reflection, they have a limited understanding of issues associated with scientific uncertainty, and they may lack an interdisciplinary understanding about ethical issues” [102] concluding that there is a “need for tailored ethics training for staff members and an increased awareness of how the healthcare professionals’ previous training shapes their process of ethical reflection” [102].

1.4. Occupational Therapy and Governance of STIs

A brief literature review involving the search for “occupational therapy” in the academic database Scopus, which includes 100% of the Medline database articles using the inclusion criteria “all fields” and “no time restriction” in conjunction with “science and technology governance” or “governance of science and technology”, “anticipatory governance”, “democratizing science”, “technology and innovation”, “democratizing science” and “participatory technology assessment” generated no hits. For the term “responsible innovation” $n=8$ hits were obtained. Searching the 70 databases within the EBSCO All umbrella database for “occupational therapy” using the inclusion criteria “all text”, peer reviewed articles and “no time restriction” generated no hits in conjunction with “science and technology governance”, “governance of science and technology”, “anticipatory governance”, “democratizing science”, “technology and innovation”, “democratizing science” and “participatory technology assessment”. For the term “responsible innovation” $n=1$ hit was obtained. The literature review suggests that occupational therapy might have the same problems in relation to STI governance as outlined for social work in [101].

2. Method

2.1. Design

Mixed-method studies can be performed at the paradigm, method and technique level [103]. We performed a mixed-methods approach at the technique

level [103] which means we used a mixed method approach for data sampling, collection and analysis [103]. We used the mixed method approach for complementarity reasons whereby we used the qualitative data obtained from the comment boxes “to add context to the quantitative results” [103]. We used a directed content analysis of the qualitative data and frequency count and percentage measures of the descriptive quantitative data to explore the views of students from two occupational therapy programs on: STI governance, specific emerging STIs (social robot, autonomous car, brain machine interfaces), one increasingly enabled consequence of STI (human enhancement) in general and in particular the impact on occupational therapy as a field, occupational therapy clients and various occupational concepts. An online survey was chosen to reach as many student participants as possible [104] and to give students the flexibility to participate in this study at their convenience. The questions in the survey were ‘Yes/No’ questions with open comments to allow participants to further expand on their responses [105] and to allow for the comparison of the comments (qualitative data) with the ‘Yes/No’ responses (quantitative data) [106] (an approach used by others [107–113]). This research design also allowed for multiple measurements of the same question [114]. The survey received ethics approval from the University of Calgary. The online survey was set in such a way that we could not identify the participants neither their IP address. The consent form alerted participants that the US government could access data as survey monkey falls under U.S jurisdiction. Participants could stop the survey at any time and were free to choose which questions they want to answer or not.

2.2. Participants

Students were chosen as participants because student education is an important aspect of Occupational Therapy. Two Canadian Occupational Therapy Schools were chosen as participants for convenience purposes. The response rate from students of the two Occupational Therapy programs reflects 30% of the students in the programs. 94.17% ($n=97$) were female and 5.82% ($n=6$) were male. As to age, 95.14% ($n=98$) were between the age of 18–30 and 4.85% ($n=5$) were between the age of 30–65. All students resided in Canada. As to level of education, 90.72% ($n=88$) were occupational therapy students who had NOT obtained an occupational therapy assistant diploma before; 4.12% ($n=4$) were occupational

therapy students who had obtained an occupational therapy assistant diploma before; 2.06 ($n=2$) were participants who had NOT obtained an occupational therapy assistant diploma and who want to obtain an occupational therapy degree in the future; 2.06% ($n=2$) were occupational therapists and 1.03% ($n=1$) was an occupational therapy faculty.

As to prior degrees: Bachelor of Arts ($n=7$), Bachelor of Kinesiology ($n=20$) Bachelor of Education ($n=5$), Bachelor of Science or Arts with Specialization in Psychology ($n=18$), Bachelor of Health Science ($n=7$) Bachelor of Science ($n=10$) Bachelor degree in English literature ($n=1$); Bachelor of Arts in Child and Youth Care ($n=1$), Bachelor in Community Rehabilitation ($n=6$), BSc in Human Kinetics ($n=3$) Therapeutic recreation BSc ($n=1$), BSc. Honors Neuroscience ($n=3$), B.S. Business Management ($n=1$), Bachelor of Arts in Recreation and health education ($n=2$), Bachelor of physical education ($n=2$) Bachelor in social science ($n=2$), Early Childhood Studies ($n=2$), Bachelor of Music, Bachelor of Environmental Studies ($n=1$) Bachelor of Science in Nursing ($n=1$) and Bachelor of Arts: Gender and Women's Studies ($n=1$).

2.3. Survey question development

The survey consisted of $n=26$ questions including demographic, simple yes or no questions with the option for comments (questions 13, 14, 18–26) and open-ended questions (questions 10–12, 15–17) to obtain more detailed views of participants. It was developed by two of the authors and given for feedback to the remaining authors keeping in mind the focus of the study, the mission of Occupational Therapy, and the literature around STI governance and the STI products covered in this study.

The questions covered: a) Demographics, b) participants views on the field of occupational therapy, on who the clients of occupational therapy are and the meaning of the term occupation, c) participants familiarity with various science and technology governance terms, d) participants views on the impact of science and technology governance on occupational therapy and its clients, e) participants familiarity with the concepts of occupational enablement, occupational sustainability, occupational justice, occupational rights, occupational satisfaction, meaning of occupation, occupational identity, occupational being, occupational participation and occupational self, and participants views on the impact of science and technology governance on these concepts, f)

familiarity of participants with human performance enhancement beyond the normal functioning of the body, brain machine interfaces, robots, industrial robots, service robots, social robots, autonomous cars and self-driving cars, and the participant views on the impact of these products on occupational therapy, its clients and on the occupational concepts mentioned before and g) participants views on why occupational therapy is invisible in the science and technology governance discourses and discourses around the STI products covered.

2.4. Data collection

Data was collected through an online delivered survey using the Survey Monkey Platform. The survey received ethics approval from the University of Calgary's Health Research Ethics board. The link to the online survey was sent to the students through a department administrator of the two occupational therapy schools after ethics approval was received. The survey data was collected between September 2016 and November 2016.

2.5. Data analysis

Quantitative data was extracted and analysed using Survey Monkey's intrinsic frequency distribution analysis capability. The qualitative data obtained from comment boxes that accompanied certain questions and the open ended questions was exported as one pdf file into Atlas-Ti software for analysis [115, 116]. A directed content analysis was performed to enlarge the scope of research on science and technology governance and certain science and technology products in relation to occupational therapy that "would benefit from further description" [115]. Directed content analysis also makes use of prior research [115] which in our case, is the brief literature review we conducted that showed that occupational therapy is invisible in discussions around STI governance frameworks. The coding is deductive in the sense that the top level themes are defined by the questions of the survey which were generated based on the authors' prior knowledge of the literature and to fill a gap of knowledge [117, 118]. However, the sub-themes that emerged under the top level theme were not pre-set and as such could be seen as an inductive approach [117, 118].

Regarding the analysis of the qualitative data, two of the authors first familiarized themselves with the qualitative data by reading the whole PDF, then re-

read the content identifying potentially meaningful data though performing semantic coding on the data [119]. The authors then identified themes based on meaning, repetition, some of the interview questions and the research question.

2.6. *Trustworthiness measures*

Credibility/dependability, transferability, and confirmability are four trustworthiness measures [120–122]. To enhance credibility [123], the authors that coded the PDF containing the qualitative data, engaged in peer debriefing. Differences in codes and theme suggestions were discussed between the two authors that coded the PDF and revised as needed. Dependability is evident in the audit trail made possible by using Memo and coding functions within ATLAS.ti-7®. It is not the intent of our study to be generalizable, however, the data we provide allows for transferability whereby others can decide whether they might want to perform a similar study [123]. Indeed, our article gives enough details that the same or similar questions can be asked of occupational therapy students in other places and students linked to other occupation areas such as occupational therapy assistants, occupational science students or occupational health and safety students.

2.7. *Limitation*

Given that we used an online delivered survey instrument with comment boxes, we could not ask for clarifications of answers. Also, there might be a selection bias in the sense that only students that were already interested in the topic might have chosen to answer the survey.

3. Results

The findings in this study are presented in four sections:

Section 1: covers some framework of reference as to what students felt occupational therapy is (question 10), who they see as occupational therapy clients (question 11), what they think the term occupation entails (question 12), and their familiarity with a variety of occupational concepts (questions 13). The views of the students are then used to discuss the next three sections of the results.

Section 2: covers the knowledge and views participants had of specific STI (question 20 and 21), and

their impact on occupational therapy, occupational therapy clients and occupational concepts (questions 22–24).

Section 3: covers the knowledge and views participants had of STI governance (question 13 and 14), and their impact on occupational therapy, occupational therapy clients and occupational concepts (questions 15–17).

Section 4: engages with the students' thoughts about the visibility of occupational therapy [or lack of] within STI governance discourses (question 25 and 26).

3.1. *Views on occupational therapy, occupational therapy clients and occupational concepts*

In short, the 48 open ended responses to question 10 revealed that helping and enabling are the main terms used to characterize occupational therapy. Other themes were enabling independence ($n = 7$) and client centered health care practice ($n = 4$). $N = 27$ saw anyone as an occupational therapy client (question 11); some linked the occupational therapy client to people that cannot do meaningful or necessary activities ($n = 25$); $n = 18$ mentioned people one would see as impaired such as individuals with disabilities, injuries, or chronic diseases/conditions, mental health issues, physical issues, mental/cognitive health, physical health and social health, physical health (neurological/biomedical/bio-mechanical), or emotional health, spinal cord injury, acquired brain injury, children with developmental or learning disorders, Individuals with musculoskeletal injuries or limitations, mental health patients, adolescents and youth with developmental disorders or mental illness, the geriatric population (functional independence decreases with old age), patients with other types of chronic illnesses - cancer patients, diabetes, heart disease. As to the $n = 49$ that commented on occupation (question 12), most stated that occupation is any “activity that is considered meaningful to the individual”, or “occupation is anything that people do”. The CMOP-E Model, Self-care, productivity, and leisure were often mentioned as sub-components ($n = 26$). As to the familiarity with occupational concepts, the familiarity with “occupation” was (100%); occupational enablement, (93.33%), occupational sustainability (77.78%), occupational justice (85%); occupational rights (76.67%); occupational satisfaction (91.67%); meaning of occupation (95%); occupational identity (85%); occupational being

(76.67%); occupational participation (91.67%) and occupational self (71.67%).

3.2. Views on STI

We asked participants about the following STIs: human performance enhancement beyond the normal functioning of the body, brain machine interfaces, robots in general, industrial robots, service robots, social robots, autonomous cars and self-driving car.

Regarding quantitative data, we found that depending on the specific STI the rate of having heard of a STI ranged from 44.68% for the brain machine interface to 93.62% for the self-driving car (Table 1, question 20). With respect to the students who have not heard about them, around one quarter stated that they should have heard about them, with around three quarters stating they did not know (Table 2 question 21). Between 66%–92% believed that the STIs impact occupational therapy (Table 3: Q22) with the rest stating they do not know. For most STIs, none stated that the STI do not impact occupational therapy. Similar results were obtained asking about the impact of STI on occupational therapy clients (Table 4: Q23). As to the impact of specific STI on occupation in general and the specific occupational concepts used in this study, more students saw positive effects than negative effects with between 20–50% stating they don't know (Table 5: Q24).

As to the qualitative data obtained through comment boxes, the answers to question 20 indicated that media was the main source of information (n=27), followed by the occupational therapy degree (n=10), the undergraduate degree (n=8) and friends (n=8) (Table 6). As to question 21, the ones who did not hear about the STI covered the two answers with more than one participant were undergraduate degree (n=5) and media (n=3) (Table 7). As to their impact on occupational therapy (question 22), n=9 felt education, scholarly work and practitioner were impacted (Table 8). Enablement of clients was the number one response (n=10) in question 23 (Table 9). As to responses to question 24 around impact on occupational concepts, the main theme was that the STIs enable or disable based on context (Table 10).

To give two quotes:

“Education: yes, because I imagine these will be in our curriculum, and hands-on lab work will be necessary to learn about such products as robots and cars Scholarly work: yes, to test the effectiveness of these products. These products cost money, in order to get the consumer or the provider to pay for these things, there should be evidence that they are effective Practitioner: absolutely, as we have the ability to recommend or not recommend these products to our clients. These all have the potential

Table 1
Q20 Have you heard of . . . before?

Technology	Yes	No	Response Count
Human performance enhancement beyond the normal functioning of the body	28 (59.57%)	19 (40.43%)	47
Brain machine interfaces	21 (44.68%)	26 (55.32)	47
Robots	46 (97.87%)	1 (2.13%)	47
Industrial robots	31 (65.96%)	16 (34.04%)	47
Service robots	31 (65.96%)	16 (34.04%)	47
Social robots	27 (57.45%)	20(42.55%)	47
Autonomous cars	25 (53.19%)	22 (46.81%)	47
Self-driving car	44 (93.62%)	3 (6.38%)	47

Table 2
Q21 If you answered question 20 with “No” should you have heard of?

Technology	Yes	No	Don't know	Response Count
Human performance enhancement beyond the normal functioning of the body	8 (28.57%)	1 (3.57%)	19 (67.86%)	28
Brain machine interfaces	6 (21.43%)	0	22 (78.57%)	28
Robots	8 (34.78%)	0	15 (65.21%)	23
Industrial robots	8 (32%)	0	17 (68%)	25
Service robots	7 (28%)	0	18 (72%)	25
Social robots	5 (19.23%)	0	21 (80.77%)	26
Autonomous cars	5 (19.23%)	0	21 (80.77%)	26
Self-driving car	6 (27.27%)	0	16 (72.73%)	22

Table 3
Q22 Do you think . . . impact OT? If yes how and what part of OT (education, scholarly work, practitioner)? If not, why not?

Technology	Yes	No	Don't Know	Response Count
Human performance enhancement beyond the normal functioning of the body	31 (68.89%)	1 (2.22%)	13 (28.89%)	45
Brain machine interfaces	30 (66.67%)	0	15 (33.33%)	45
Robots	41 (91.11%)	1 (2.22%)	3 (6.67%)	45
Industrial robots	32 (71.11%)	2 (4.44%)	11 (24.44%)	45
Service robots	34 (75.56%)	0	11 (24.44%)	45
Social robots	36 (80%)	0	9 (20%)	45
Autonomous cars	32 (71.11%)	0	13 (28.89%)	45
Self-driving car	41 (91.11%)	0	4 (8.89%)	45

Table 4
Q23 Do you think... impact OT clients?

keyword	Yes	No	Don't know	Response count
Human performance enhancement beyond the normal functioning of the body	31 (68.89%)	0	14 (31.11%)	45
Brain machine interfaces	30 (66.67%)	0	15 (33.33%)	45
Robots	38 (84.44%)	0	7 (15.56%)	45
Industrial robots	30 (66.67%)	3 (6.67%)	12 (26.67%)	45
Service robots	35 (77.78%)	0	10 (22.22%)	45
Social robots	34 (75.56%)	0	11 (24.44%)	45
Autonomous cars	31 (68.89%)	0	14 (31.11%)	45
Self-driving car	39 (86.67%)	0	6 (13.33%)	45

to significantly impact our clients' occupational performance and satisfaction, so we should know about these things and recommend them wisely”.

“HPE: for the most part, I don't think that this currently impacts OT on a practical level. Based on my experiences, OT services are very rehabilitation-based and there is very little (if any) focus on bringing someone above a so-called normal level. This may be different in privatized OT services, but in the public sector it seems very focused on restoring function to the so-called “normal” level. Robots + autonomous cars: could be used to enable occupation and increase accessibility for clients with various impairments.”

To give two more quotes related to answers in Tables 9 and 10.

“As in the case of steroids, we can see that HPE can have both positive effects (stronger, faster) and negative effects (side effects) on occupation and occupational enablement. Robots and cars can have both pos and neg impacts also, as having a robot to do things for you or a car to drive you around might reduce/eliminate your ability to do those things on your own. Likewise, HPE, robots, and cars will certainly improve occupa-

tional satisfaction by allowing a person to engage in more activities. But these might also reduce their satisfaction as the person might feel that they didn't “earn” or “work for” these positive outcomes...as if they somehow cheated. It all depends on how the individual defines “participation” and accomplishment. These things might take meaning away from occupation, as they might feel they are a passive participant if a robot is doing everything for them. Cleaning the house might bring a person a sense of accomplishment, but now that they are no longer actively completing this activity (if say a Roomba is doing the vacuuming), the meaning once given to the act of cleaning is no longer present.”

And

“Yes, they are all impacted by the technologies, except for “Occupational Being” and “Occupational Self,” Those are innate and come first, to which we may apply technology to exploit the abilities and address the needs of occupational beings and people.”

3.3. Knowledge and views on STI governance

We asked participants about the following STI governance concepts: governance of science and

Table 6

Q20 Where they heard about it (n = 37 comments)

Answer Theme	Frequency
Media	31
OT degree	12
Undergraduate degree	10
Friends	8
TED talk	2
Doing research for my research project"	2
Alberta Children Hospital	1
Everyday life	1
Google	1
Family members	1
Out in the community	1

Table 7

(Q 21): Where they should have heard about it (n = 8 comments) (Question 21)

Answer Theme	Frequency
Undergraduate Education	5
Media	4
OT School	2
Work Environment	2
Ethics Course	1
Evidence-Based Practice Class	1
Clinical Placement	1
High School	1
Conference	1
Academic Journal	1
Assistive Technology Class	1

technology, anticipatory governance, responsible innovation, Democratizing science, technology and innovation and participatory technology assessment.

Our quantitative data demonstrated that depending on the specific STI governance term, the rate of having heard of it ranged from 4.44% for participatory technology assessment to 33.33 % for “responsible innovation) (Table 11, question 13). For the ones who have not heard about them, depending on the STI governance term, between approximately 20–40% of participants felt they should have heard about them with around 56%–76% stated they did not know, with slight variations between the STI governance terms (Table 12 question 14). As to the impact of STI governance on occupational concepts and occupation (Table 13, q 19), 37–54% saw a positive and negative impact. None saw a purely negative impact. Answers for No effect at all ranged from 0%–18% with meaning of occupation (18.52%), occupational identity (9.26%) and occupational being (11.11%). The don’t know answer ranged from 14–31%.

As to the qualitative data obtained through comment boxes and open-ended questions, the answers to question 13 indicated that the undergraduate degree

Table 8

Q22 Do you think . . . impact OT? If yes how and what part of OT (education, scholarly work, practitioner)? If not, why not? (n = 28 comments)

Answer Theme	Frequency
Practitioner mentioned by itself without education or scholarly work)	11
Enabling	10
Impacts OT all three (education, scholarly work, practitioner)?	9
Education (mentioned by itself without practitioner or scholarly work)	4
Scholarly work (mentioned by itself without education or practitioner)	2
Disabling (cost)	2
New ethical dilemmas and tensions for OT.	2
Client more independent	2
Disabling (enhance or set up unrealistic goals for clients)	1
Disabling (replacing people in the work)	1
Have to understand STI in order to offer it to clients	1
No effect of HPE for practitioners in public sector	1
HPE might have an impact on practitioners in private sector	1
Needs regulation	1
Impact OT because OT are system thinkers	1
Changes goal of clients	1
Educate future OT on them	1

Table 9

Q23 Do you think... impact OT clients? (n = 25 comments)

Answer Theme	Frequency
Enabling clients	10
Improve quality of life	4
Enables or disables independence	3
Impact on choosing an occupation	2
Enables engagement with client such as client with dementia	1
Enables or disables clients’ occupational engagement and functioning	1
Disabling humans due to lack of purpose as purpose is taken over by robot	1
Disabling clients	1

Table 10

Q24 Do you think . . . are impacted by.? Example Do you think “occupation in general” is impacted by “HPE” (you can click on more than one answer per row)(n = 12 comments) (one theme only)

Enabling or disabling based on context	N = 12
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was the main source of knowledge on the STI governance concepts prior to the survey (n = 6) (Table 14). As to question 15, the ones who did not hear about them but felt they should have, occupational therapy school was mentioned the most (n = 6) as the sources from which they should obtain the informa-

Table 11
Question 13 Have you heard of . . . before?

Governance related terms and phrases	Yes	No	Response Count
Governance of science and technology	14 (23.33%)	46 (76.67%)	60
Anticipatory governance	6 (10%)	54 (90%)	60
Responsible innovation	17 (28.33%)	43 (71.67%)	60
Democratizing science, technology and innovation	5 (8.47%)	54 (91.53%)	59
Participatory Technology Assessment	3 (5.08%)	56 (94.91%)	59

Table 12
Q14 Should you have heard of . . .

Governance related terms and phrases	Yes	No	Don't know	Response count
Governance of science and technology	16 (26.67%)	1 (1.67%)	43 (71.67%)	60
Anticipatory governance	12 (20%)	2 (3.33%)	46 (76.67%)	60
Responsible innovation	24 (40%)	2 (3.33%)	34 (56.67%)	60
Democratizing science, technology and innovation	14 (23.73%)	1 (1.69%)	44 (74.58%)	59
Participatory technology assessment	18 (30%)	1 (1.67%)	41 (68%)	60

Table 13
Q19 Impact on occupational concepts

Keyword	Yes, positive	Yes, negative	Yes, positive and negative	No	Don't know	Response count
Occupation	16 (28.07%)	0	31(54.39%)	1 (1.75%)	9 (15.79%)	57
Occupational enablement	17 (31.48%)	0	29 (53.7%)	0	8 (14.81%)	54
Occupational sustainability	12 (22.22%)	0	27 (50%)	0	15 (27.78%)	54
Occupational justice	10 (18.52%)	0	29 (53.70%)	0	15 (27.78%)	54
Occupational rights	8 (15.09%)	0	30 (56.60%)	2 (3.77%)	13 (24.53%)	53
Occupational satisfaction	16 (29.63%)	0	28 (51.85%)	0	10 (18.52%)	54
Meaning of occupation	13 (24.07%)	0	21 (38.89%)	10(18.52%)	10 (18.52%)	54
Occupational identity	11 (20.37%)	0	25 (46.30%)	5 (9.26%)	13 (24.07%)	54
Occupational being	14 (25.93%)	0	20 (37.04%)	6 (11.11%)	14 (25.93%)	54
Occupational participation	19 (34.54%)	0	27 (49.09%)	1 (1.82%)	8 (14.55%)	55
Occupational self	12 (22.22%)	0	22 (40.74%)	3 (5.56%)	17 (31.48%)	54

Table 14
(Q 13) Where did they hear about it
(18 comments)

Answer Theme	Frequency
Undergraduate Education	7
OT School	5
Media	3
Assistive Technology Class	1

Table 15
(Q15): Where they should have heard about it
(n=21 comments)

Answer Theme	Frequency
OT school	11
Undergraduate education	7
Media	4
Grad classes	3
High School	3
Work environment	2
Academic journal	2
assistive technology class	1
Ethics course	1
Evidence Based Practice class	1
Clinical placement	1
conference	1
Professional journal	1
Business class	1
Occupational justice class	1

tion, with fifteen other sources suggested (Table 15). Regarding the impact on occupational therapy (question 16), n = 16 felt education, scholarly work and practitioners were impacted (Table 16). As to impact on occupational therapy clients (question 17), the top three mentions were impact on service, n = 9; enabling client, n = 4 and best evidence-based practice for clients, n = 8 (Table 17).

To give one quote

“As OTs I think these topics are of great relevance to our profession. I do not believe information on these topics is readily available to us though, and if they are I do not know where to find them. As

a profession that can be heavily involved in the use, prescription, and adaptation of equipment for individuals, I think it would be important that we become more aware of these topics and how they may impact our professional lives. Perhaps

Table 16
(Q16): Impact of STI governance on OT (44 comment)

All that answered saw an impact: Without focusing on given governance term:	
Answer Theme	Frequency
Impact on service	25
Practice	9
Education	8
Scholarly work	7
The community	5
all areas of OT (education, scholarly work, and practitioner)	5
evidence based knowledge or practice	4
Access to technology	3
Quality of care for clients	3
Funding	1

Table 17
(Q17): Impact of STI governance on OT client. N = 37 comments were received

All that answered saw an impact: Without focusing on given governance term:	
Answer Theme	Frequency
Impact on service	11
Enabling client	10
Best evidence-based practice for clients	8
Quality of therapy	7
Clients reality of life globally	3
Access for clients	1
Potential decrease of influence of "softer science"	1

we could learn about it more in our schooling and workplaces. In services perhaps? Or maybe there could be professional networks dedicated to discussing these types of topics across disciplines?"

To give five quotes:

"Education because students are usually taught the up to date research findings, scholarly work because the trends of research do affect what research is funded and conducted, and all this information will eventually make its way down to the practitioner from being a new graduate of a program or a practitioner that has learned something at a conference they attended and implemented the knowledge into their practice. "How we govern science can also impact science education and thus OT education as well (how we educate, policies surrounding education)."

"Yes it certainly does impact OT. The most pertinent example I can think of would be the frustration we face in not always being able to secure the most advanced or 'up to date' technologies for the individuals we work with."

"I also think it takes a long time for what is being done in research to make it out to the consumer. And this can be a down side for OTs. They may be aware of technologies that are being researched but be unable to access them for their clients. There can also be difficulty with knowledge translation and acceptance of new technologies. Not all practitioners are ready to integrate new technologies into their practice and not all clients will be accepting of new ideas if they are far from what they have encountered thus far."

"Yes, as OTs we need to be up to date with the latest innovations in technology in order to provide our clients with the best. Furthermore, OTs need to base their work on evidence and therefore create scholarly articles that contains knowledge which is easily translatable to many populations."

"Yes - it determines how we interact with clients and what kind of tools are available to us."

To give three quotes:

"Yes I do think it has an impact on our clients because the technology and interventions we provide are evidence-based and how we govern science will have an impact on our research and therefore our evidence-base."

"Governance will impact what technologies are encouraged, what access our clients will have to different technologies and techniques, etc."

"Yes- globally OT as a profession and on the front-line level; however, that is more dependent on the practicing OT and their knowledge and incorporation of science/technology/innovation."

3.4. Visibility of occupational therapy in STI governance discourses

We asked participants about their view on the invisibility of occupational therapy in discourses that shape STI governance concepts (claim 1, question 25) and in STI discourses specific to the technologies covered in the survey (Claim 2 question 26). Our quantitative data showed that 32% felt that claim 1 might be true with 65% having no opinion. Only one participant felt the claim was not true (Table 18). Furthermore, 27% felt that claim 2 might be true with 69% having no opinion. Again, only one participant felt the claim was not true (Table 19). As to the reason why occupational therapy might be invisible in shaping STI governance concepts (question

Table 18

Q25 What do you think are the reasons for the invisibility of OT students, professionals and faculty in shaping STI governance concepts listed under question 13? (Claim 1)

Statement	%	count
Don't believe the claim to be true.	2.32	1
I believe the claim could be true.	32.56	14
No opinion	65.12	28

Table 19

Q26 What are the reasons for the invisibility of OT students, professionals and faculty in the governance of the technologies listed under question 20? (Claim 2)

Statement	%	count
Don't believe the claim to be true.	2.33	1
I believe the claim could be true.	27.91	12
No opinion	69.77	30

Table 20

(Q25): Invisibility of OT in shaping STI governance concepts (N = 12 comments)

Answer Theme	Frequency
OT is not known and recognized	5
Lack of knowledge within OT students, professionals and faculty	5
OT still developing and as such to be part of these discourses not a priority	2
Discussion/education/conversation about the ethical/social/moral dilemmas associated with technology use in the OT profession	1
Do not know how to get involved	1
Lack of coverage in curriculum	1
Too many other problems to deal with	1
Not seen as scope of practice	1

25) the two main reasons given were occupational therapy is not known and recognized ($n = 5$) and lack of knowledge within occupational therapy students, professionals and faculty ($n = 5$) (Table 20). As to the invisibility of occupational therapy in shaping STI governance discourses around the STI covered in the survey (question 26) the main reason given was that occupational therapy is not known and recognized ($n = 5$) (Table 21).

To give two quotes:

“I think OTs often see themselves in a position to advocate for access to technologies for their clients but may not feel well positioned to be involved in the governance of technologies. However I do see OTs as being uniquely and well positioned to support the governance, creation, and development of science and technology in conjunction with other disciplines (for ex. engineers, designers, software techs, etc.). Although

Table 21

(Q26): Invisibility of OT in shaping STI governance discourses around the STI covered in the survey (N = 11 comments)

Answer Theme	Frequency
OT is not known and recognized	N = 5
OT viewed as consumers but not innovators	N = 1
Not seen to be involved in changing policies	N = 1
Too much focus of collaborating with other health disciplines and not with science and engineering	N = 1
OT develops their own rules	N = 1

as OTs we do not carry expertise in the ‘science’ of technology development we do offer expertise in the future uses of and potential needs for technologies so could certainly inform the design process”

“OT is not a popular profession and those who do govern STI may not even think about the effect it has on OT”.

To give two quotes

“maybe because lot of the time we are viewed as the consumer who will use or prescribe these equipment but not necessarily innovators you could change policies, probably not much of a background in this area (more clinical practice?)”

“We focus so much on interdisciplinary cooperation and communication with other HEALTH professions, but it seems there is little effort to coordinate with science and engineering, so we have little to no say in the direction that these technologies take.”

4. Discussion

Many studies have engaged with various aspects of STI governance such as outreach and education. However, no empirical studies [to our knowledge] have engaged with the views of occupational therapy students, occupational therapists or occupational therapy faculty for that matter. The views of our participants suggest that it would be beneficial for the STI governance community to actively engage with occupational therapy but also that occupational therapy should engage with STI governance. Our findings suggest that changes might be warranted in the education of occupational therapy students, in the lifelong learning and professional development of occupational therapists, and in the focus

of education performed by the STI governance community.

4.1. *Implications for occupational therapy*

Helping and enabling are the main terms used by our participants to describe occupational therapy; anyone was the main characterization of occupational therapy clients; and occupation was seen to be “any activity that is considered meaningful to the individual” or “occupation is anything that people do”. Furthermore, the CMOP-E model with its self-care, productivity, and leisure sub-components was often mentioned. That students situate occupational therapy in such a broad way such as seeing “any” as their clients and “any meaningful occupation” as occupation indicates that STI and its governance impacts occupational therapy and its clients in many areas. Indeed, most of the $n = 31$ participants that indicated that how we govern (manage) STI impacts occupational therapy stated that all areas of occupational therapy (education, scholarly work, and practitioner) are impacted. The views of participants suggest the need for occupational therapy (students, educators, scholars and practitioners) to at least be aware of STI, not only on the level of individual utility but also on the societal level discussed within STI governance. The “any” occupation and “anyone” as clients suggests an impact of STI and its governance on who is an occupational therapy client and indicates that changes in the meaning of occupation also impacts occupational therapy practice. Human enhancement beyond the normal for example might change occupational therapy in at least two possible ways. One being that individuals classified as non-enhanced might become the clients of occupational therapists as they might lose access to certain occupations and must find new ways to define themselves as occupational beings. The other change might be that the enhanced individuals might generate new occupations; whereby the occupational therapy discourse will have to think about whether these enhancements must become accessible to the non-enhanced. As such, occupational therapy might see itself pushed toward promoting access to enhancement in tune with recommendations 1–4 of [82].

The findings that showed that the majority have not heard of the STI governance concepts before, that only 1–3% indicated that there was no need for them to know about the concepts, and that undergraduate degrees and occupational therapy schools were the top sources mentioned as to where they should

hear about STI governance indicates the need for various actions by occupational therapy as a field such as being part of the STI governance discussions. Being part of the STI governance discussions is also in tune with for example recommendation 5 of [82] which asks occupational therapists to be “knowledgeable of the ethical use of assistive technology” and to “advocate for the ethical application of this technology”. It is also in tune with point 4 of the same document that provides background for the recommendations stating “Ethical provision of assistive technology balances the client’s rights with rights of their caregivers, community, and society” [82]. That occupational therapists should generate research on the development and outcome of assistive devices (recommendation 6 [82]) also indicates the utility for occupational therapy to join STI governance discourses so that it can influence STI developments and outcomes through advocacy and transfer of their knowledge to the STI governance field and research.

4.1.1. *The issue of education*

Given that occupational therapy schools were one of the top sources mentioned as to where participants felt they should have heard about STI governance concepts suggests that changes in education might be warranted. It also fits with policy documents generated within occupational therapy as a field. A case that could be made for the usefulness of partaking in and influencing STI governance discussions and for closer links between the occupational therapy and the STI governance community is that it fits with wordings from the European Network of Occupational Therapy in higher education strategic plan 2016–2020 [59]. Given the strategic plan the linkage could be seen in the opportunity to “promote the OT contribution and role in the health and social system within emerging fields” which seems to be pressing given that students felt that occupational therapy is not known and recognized enough. It also fits with the need to increase competencies related to “social, political, cultural and technological development, entrepreneurship, innovation and internationalization”, the opportunity “to build a solid relation between theory discourses, practice actions and research in different interdisciplinary projects”, and the need “to raise awareness of the importance of occupational therapy among the public, community, opinion makers, politicians and decision makers” as stated in the strategic plan [59].

The STI products we covered in our study (robotic, brain machine interfaces, human enhancement, and

autonomous cars) are all emerging STI whereby the impact on occupation (individual and societal level) can still be shaped. As such, occupational therapy can have an impact with its knowledge on occupation. Being involved in STI governance in a continuous fashion will raise the awareness of the importance of occupational therapy among the public, community, opinion makers, politicians and decision makers as many of the STI governance issues are occupation related. It could also increase competencies in social, political, cultural and technological development, entrepreneurship, innovation and internationalization areas of members of the occupational therapy community.

Being part of STI governance discourses will also contribute to preparing students for their future role in society as asked for by the TUNING project which focuses on occupational therapy education in Europe [124] and will enhance nearly all of the competencies listed by the TUNING project such as: “Identify the need for research on issues related to occupation, occupational therapy and/or occupational science and formulate relevant research questions”; “Develop new knowledge of occupation and occupational therapy practice, particularly in relation to local and/or emerging health and social challenges”; “Take a pro-active role in the development, improvement and promotion of occupational therapy”; and “Consider developments and influence policies in health and social care, society and legislation at international, national and local levels that affect occupational therapy services” [124].

Occupational therapy is already involved in individual STI impact assessments and assistive technology development (see for example [125]) which also adds to the competencies of occupational therapists listed above. However, we submit that STI governance discussions on a given STI and the discussions around how to govern STI in general go beyond STI utility discussions such as standard setting and individual utility assessment discussions. To give one example; robotics is increasingly seen to impact occupation [3, 18]. The use of robotics such as social robotics for disabled people is looked at from an individual acceptability and utility perspective [126]. However, robotics pose societal problems of technological unemployment for the general population [2, 5, 127, 128] and for disabled people [5] leading to potential decrease in health and well-being. Such societal impacts cannot be engaged with under the focus of individual utility. The same is true for human enhancement, autonomous

cars or other forms of automation and of brain machine interfaces.

Still, changing the curricula for students and enticing interdisciplinary research between the two groups is not enough. Students that leave the University and do not move into academia will lose access to many of the sources they have as students to inform themselves about STI and their governance discussions, discussions that constantly will impact the practice of occupational therapy. STI challenges for occupational therapy practice will emerge, ones that were not taught in occupational therapy school even if the courses offered the newest content at a given time.

4.1.2. Lifelong learning

Lifelong learning is an occupational therapy goal [124, 129–134] which includes creation, dissemination, application, and translation of knowledge [135]. STI is also linked to lifelong learning [136, 137]. Given the ever changing STI landscape, what is the best way to provide the opportunity and motivation for lifelong learning on STI topics especially on the anticipatory and societal impact level as pushed for within STI governance discourses? To have a national database that lists continuing professional education resources [134] could be one way to become aware of STI governance related learning and engagement opportunities. However, this would only be valid if the database is up to date and if it includes resources for use. The resulting knowledge might inspire practitioners to become involved in STI governance to shape the impact of STI on their work and their clients. It also might enable occupational therapists to foresee future challenges as well as opportunities for their job and their clients. Another way could be to set up newsgroups for occupational therapy students, academics and practitioners where one gets news and other information on STI governance. However, there are other issues beyond the technical means of dissemination of knowledge, namely the way in which one can provide the living space where practitioners are able to continuously learn about STI and their governance and to contribute to the discussions. Indeed we could not find literature covering this aspect.

Given that the time period between the appearances of new STI seem to become smaller and smaller, how can one stay up to date? The occasional lecture or provision of a document or news item is not enough. The International Association for Public Participation (IAP2), describes five different public participation categories, depending on the “power balance” between the policy maker and the citizen,

or as they state, the “level of public impact” namely informing, consulting, involving: collaborating and empowering” [138]. Given the speed of STI change on the one hand and the frequency of involvement in continuous professional education, one might be barely making the “informing level” of the ladder. We submit the need for a culture shift where STI governance is discussed at the water cooler, in pubs or other gatherings as is the weather or sports. This might be the only way to guarantee that practitioners in general and others can move up on the ladder of participation.

4.2. *Implication for STI governance discourses*

STI constantly impacts the landscape of occupation, whether they make certain occupations obsolete, generate new forms of occupation or change existing occupations. Taking the cue from the participant’s broad understanding of occupation, STI impacts nearly every aspect of a person’s life. At the same time, our academic database search outlined earlier found that occupational therapy and various STI concepts do not show up together in academic articles. This does not only indicate that occupational therapy does not engage with STI governance but also that STI governance does not engage with occupational therapy. Our findings suggest needed action not only on the level of occupational therapy but also on the level of STI governance discourses which did not note or thematized the absence of the occupational therapy community. Indeed, participants felt that they have something to contribute:

“I think OTs often see themselves in a position to advocate for access to technologies for their clients but may not feel well positioned to be involved in the governance of technologies. However I do see OTs as being uniquely and well positioned to support the governance, creation, and development of science and technology in conjunction with other disciplines (for ex. engineers, designers, software techs, etc.). Although as OTs we do not carry expertise in the ‘science’ of technology development we do offer expertise in the future uses of and potential needs for technologies so could certainly inform the design process” and another “OT is not a popular profession and those who do govern STI may not even think about the effect it has on OT.”

We suggest that the STI governance discourses should involve the occupational therapy community

right at the beginning of the conceptualization of an STI product. Within the discussions of STI governance, science, education and knowledge creation play a central role. A lot has been written about involving natural scientists and engineers [47, 139] on the one hand and the public [140, 141] on the other in the governance of STI. However, various practitioner groups seem to be missing in the narrative of involving stakeholders in the governance of STI such as social workers [142]. Occupational therapists are part of this gap of practitioners being identified as stakeholders. Their lack of involvement seems to go against the indicators of success of STI discourses such as responsible innovation, which sees the education of researchers and other societal actors to become good responsible innovation actors as an indicator of success [48]. Education is not only an indicator and an aspect of STI governance discourses such as responsible innovation [48, 143–145] but is also covered in anticipatory governance [146–150] and STI governance in general [151–160]. The problem of achieving sufficient knowledge on STI product is raised as an issue [161–163] as is whether increasing the knowledge on a STI changes ones engagement with STI governance [29]. However, very little can be found on how to increase the ability of people or groups to discuss STI governance on a level that gives them power to influence STI governance discourses. A 2015 European Commission report on what should be the indicators of success for responsible innovation lists science education as one indicator [48, 164]. It is stated that “policymakers also have a responsibility to anticipate and assess potential implications and societal expectations with regard to research and innovation, with the aim of fostering the design of inclusive and sustainable research and innovation. Through this last dimension, we will develop harmonious Governance models for responsible research and innovation that also integrate public engagement, gender equality, science education, open access/science and ethics” [165]. However, ‘science education’ is different than educating someone to allow them to partake and influence STI governance discussions. RRI Tools is a research project that generates tools stakeholders can use. Interestingly, the RRI Tools project lists the following as stakeholders; policy makers, research community, education community, business and industry and civil society organizations [166] overlooking some professionals which indicates some gaps in the discourse. However, most STI governance discourses are theoretical and evalu-

ative of existing stakeholder involvements. Indeed, little literature [101, 102] can be found that thematizes professionals to partake and influence the STI governance discussions. Again, using the five public participation categories from the International Association for Public Participation (IAP2) namely informing, consulting, involving, collaborating and empowering [138] it seems that as to occupational therapy one is not even at stage one (informing) yet. Participants indicated that they should have heard about STI governance in occupational therapy school or in their undergraduate program. This indicates that STI governance should become broadly taught in University bachelor degrees, exposing students to the topic. This can be followed up with students who enter occupational therapy Masters degrees to be further exposed on the topic with occupational therapy specific content. In the cases of occupational therapy Assistant training and occupational therapy degrees on the undergraduate level, one could teach about STI governance directly in these degrees.

5. Conclusion

Our data suggests that students see the need to be informed of STI developments as early as on the undergraduate level. Our findings suggest that a change of curricula might be warranted in occupational therapy Schools so that occupational therapy students can gain insight into contemporary STI developments and their governance that will impact their field and clients. Our data further suggest that a change of curricula in other degrees especially on the undergraduate level might also be warranted to increase the STI and STI governance literacy. Moreover, new approaches to lifelong learning, continuing professional education and participation in STI governance endeavors must be developed.

Our findings imply that there might be a utility for the development of strategies with the goal of leading to cross-inspiration between occupational therapy students, scholars and practitioners and various members of the governance of STI community such as students, scholars, policy makers and community members. This will allow occupational therapy students to decide whether they might want to be part of STI governance discussions, do research on an STI governance topic or to focus on STI governance as occupational therapy academics. It will give them the knowledge to continue informing themselves as practitioners on developments of the STI they

learned about in University through social media, certain webpages and open access academic literature. In addition, it will equip them with the skills that will allow them to search for emerging STI and governance discussions they have not learned about in University. It may also change the expectations former students and current practitioners have from lifelong learning in relation to anticipatory and societal impact knowledge of STI. This cross-inspiration will also broaden the views of the STI governance community on the issue of occupation.

Further research might be useful to ascertain the views of the STI governance community around occupational therapy and occupational therapists as stakeholders in STI governance discussions. It might also be worthwhile to ascertain the views of the STI governance community on other fields involved in occupational issues such as occupational science, occupational health and safety and back to work. Furthermore, it might be useful to ascertain the views of occupational therapy practitioners, educators and researchers on STI governance and on how to instrumentalize lifelong learning to enable knowledge on and involvement in STI governance. Finally, it might be worthwhile to ascertain the views of occupational science students and faculty, occupational health and safety practitioners, educators, students and researchers, and back to work practitioners on the same topics of utility of knowing of and contributing to STI governance discussions and on how to shape lifelong learning for that goal.

Conflict of interest

None to report.

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