Module 2- TRN CULTURAL KNOWLEDGE, Learning Unit 2.1 Types and Uses of SARs in Health and Social Care

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THEORETICAL COMPONENT

Papadopoulos et al, 2019 support that socially assistive humanoid robots are considered a promising technology to tackle the challenges in health and social care posed by the growth of the ageing population, and they provide a major opportunity towards meeting some of the care needs of older adults. Social Assistive Robots (SARs) are designed and developed for use in the hospital and at home to offer patients physical, cognitive and social exercise, guidance, and monitoring. Affordable technologies of SARs can provide patients with monitoring and motivation systems for use at home, which positively affect the prevention of chronic diseases and the reintegration of patients with long-term health problems. Furthermore, SARs can offer a new dimension to the care of older people, preventing their institutionalization, delaying the onset of dementia (constantly offering new stimuli), and providing companionship by combating social isolation and depression (Tsoulfaidou, 2019).

The principles and values that guide this tool include:

- Ensuring patient dignity
- Helping
- Innovation
- Kindness
- Caring

Aims

This learning unit aims to develop your understanding of the different types of robots that can be used in health and social care in different settings and/or at home.

Learning outcomes

At the end of this training, the participants will:

- Classify the different types of SARs depending on their functionality and are used in health and social care settings
- Identify the various uses of SARs in health and social care settings

Relevant definitions and terms

Robot. Giving an exact definition to the term 'robot' is difficult. According to the Cambridge English Dictionary (n.d), a robot is a machine controlled by a computer that is used to perform jobs automatically. Although 'performing jobs automatically' is a key element in robotics, that element also exists in other simpler machines (i.e, dishwasher), which can make distinguishing robots based only on this criterion difficult - it is also noted that one important factor of robots that often is not mentioned in the definition, is the use of sensors (Ben-Ari and Mondada, 2018). Another definition is offered by the International Organization for Standardization (2012), stating that a robot is an actuated mechanism with a degree of autonomy, moving within its environment, to perform intended tasks.

Robots can be classified using different criteria, for example, based on their application field, environment, and mechanism of interaction (Ben-Ari and Mondada, 2018; Dobra 2014*), control systems, size, design, etc. (Dobra, 2014*). Whatever their application field and capabilities, robots are typically used for replacing the human component to complete a specific task (Syriopoulou-Delli & Gkiolnta, 2020). The origin of the word robot comes from the Czech word "robota" meaning forced labor (Murphy, 2000).

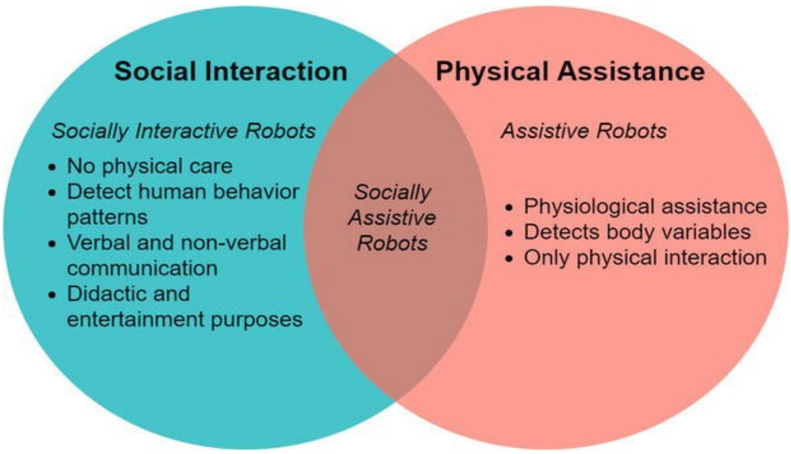
The concept of "robot" may be visualized differently in different cultures. According to (Haring et al. 2014), "A preliminary study through a Google image search revealed that for all countries, the term robot is mostly associated with humanoid robots, but with a different frequency of occurrence. Arabic and African countries show a high percentage of robot-related images like comics, toys, and others (e.g. United Arabic Emirates 58%, Egypt 70%) whereas countries associated as technological highly developed countries like the US, Japan or Germany not only show more "real" robots (Japan and US 71% humanoid robots) but also a wider diversity of robots. Robots that look almost exactly like human beings are mainly particular for Japan, although they exist and are also developed in other countries."

Assistive robotics. Assistive robotics refers to the robots which assist people with physical disabilities through physical interaction. Research in the field of assistive robotics comprises rehabilitation robots, wheelchair robots, companion robots, manipulator arms for the physically disabled (Shah, 2017). Its functionality is based only on giving physiological assistance to a patient that presents a physical disability or is recovering from a surgical operation. This type of robot usually presents a carefully designed structure depending on its functionality since they have one single task and the work environment does not vary too often.

Socially assistive robot (SAR). The combination of Assistive Robots and Social Robots is called a Socially Assistive Robot (SAR). SAR is a type of robot whose primary goal is to create close and effective interaction with a human user for the purpose of providing company, fostering independent living, giving assistance, and achieving measurable progress in convalescence, rehabilitation, learning, etc. alongside or instead of physical aid (Winkle et al., 2020).

SARs share with Assistive Robots the goal to provide assistance to human users but put the emphasis on assistance through social interaction.

SARs are complex types of robots since they need to mimic human behaviour as much as possible to create the image of a personality and human-like interaction. These two objectives allow the platform to generate empathy with the users and develop more efficient communication with them. Also, by adequately reacting not only to the person but the environment as well, the robot may be capable of performing multiple tasks.



The Figure represents Socially Assistive Robots at the intersection between Social Interaction and Physical Assistance (Lopez-Caudana, 2020).

What the research says

- **Papdopoulos, I. et al. (2020). A systematic review of socially assistive robots in pre-tertiary education. Computers & Education, 155, 1-20.** The article performs a systematic literature review to examine the use of SARs in the pre-tertiary classroom teaching of mathematics and science to identify the benefits and disadvantages of such technology. The findings showed that using SARs in pre-tertiary education is promising, but studies focussing on mathematics and science are significantly under-represented. Further evidence is also required around SARs' specific contributions to learning as well as enabling/impeding factors, such as SAR's personalisation and appearance or the role of families and ethical considerations. Available here*.
- **Maalouf, N., Sidaoui, A., Elhajj, I. and Asmar, D., (2018). *Robotics in Nursing: A Scoping Review*. *Journal of Nursing Scholarship*, 50(6), pp.590-600.** The past decade has witnessed significant growth in the use of robots in nursing, especially in countries like Japan. A scoping review is presented in this document, identifying the many different applications of robotics in nursing. A total of 1,758 articles were retrieved, from which 69 articles were included in the final review. The analysis of the chosen papers led to the categorization of robots into two main categories: assistive robots and socially assistive robots. Whereas assistive robots are used for physical care, including service and monitoring tasks, socially assistive robots focus on the cognitive and emotional well-being of patients in need of companionship. After a detailed review of the state of the art, an insight into the future of robotics in this field is provided. The recommendations include the need to intensify research on human-robot interaction, a greater focus on monitoring robots, and analysis of the psychological barriers that need to be surmounted to achieve more tolerance and acceptance of robots. Available here*.
- **Pampaliari, S. (2018). *Socially Assistive Robots for the social and emotional support of children with chronic diseases*. The University of Macedonia.** This is a Greek study that examined the interaction of the robot NAO with children suffering from cancer or leukemia and being hospitalized for a long period. Certain activities were designed to improve children's social skills, to help children manage the disease, and get familiarized with the medical procedures. The participants were 6 children from the pediatric oncology department of the AHEPA University Hospital. Initially, 8 interventions were designed, 4 for the first cycle and 4 for the second. The sessions' purposes were the same in both cycles; however, the roles and the scenarios were changed. Due to some problems during the intervention, only the first cycle was held. The results from children-robot interaction were positive. More specifically, from children's attitudes towards the robot, the identification with the robot, and the children's emotional alteration during the sessions, it seemed that the children had fun, communicated, and expressed their thoughts and feelings. The robot encouraged the child to talk about the disease and its problems and think about managing them. Available here (Greek only).
- **Nikolaos Fachantidis, Christine K. Syriopoulou-Delli & Maria Zygopoulou (2020). *The effectiveness of socially assistive robotics in children with autism spectrum disorder*, International Journal of Developmental Disabilities, 66:2, 113-121.** The above study was carried out to examine the role of Socially Assistive Robotics (SAR) as an innovative educational tool in developing the social skills of children with autism as they participated in structured and suitably prepared activities. The present study was conducted using a social robot, Daisy, and a human partner to compare the results of the two different interventions. Participants in the study comprised four children with autism who are pupils at elementary school and are assisted by a special support teacher. The study was carried out in a special education center, and sessions were held outside of the regular school timetable. Eight 30-minute sessions, each comprising four activities, were held with each pupil. Results indicate positive outcomes during the interaction with the robot. Specifically, there were more incidences of eye contact, proximity, and verbal interaction during sessions with the robot than during those with the teacher. Additional behaviors such as increased attention and ability to follow instructions improved during interaction with the robot. There was also a noted reduction in fidgeting. Available here.

- **Christine K. Syriopoulou-Delli & Eleni Gkiolnta (2020)** ***Review of assistive technology in the training of children with autism spectrum disorders*****, International Journal of Developmental Disabilities.** This review aims to evaluate assistive technology in training children with Autism Spectrum Disorders (ASD) in social skills. The main objective was to assess the effectiveness of several SARs devices in developing social skills in children with ASD based on their features and characteristics, as reported in the current literature. Specifically, the authors intended to address the current literature research gap by categorizing these results by the forms of social behavior observed and discussing each one thoroughly and separately, as this hasn't been done in previous reviews. Furthermore, many reviews focus on the effects of assistive technology in enhancing the communication skills of children with autism, without any references to other forms of social skills. Therefore, the attempt was to exhibit whether or not assistive technology effectively reinforces a wide variety of social skills. Available here.
- **Cespedes, N et al. (2021)** ***A Socially Assistive Robot for Long-Term Cardiac Rehabilitation in the Real World*****. Frontiers in Neurorobotics. Vol 15.** This paper presents a real-world, long-term study where a SAR was used to provide patients with motivation and feedback, support CR phase II therapies, and improve adherence. This is the first in-depth clinical study exploring the benefits of using a socially assistive robot for long-term cardiac rehabilitation in adherence and physiological progress. Authors claim that, in contrast to previous studies where authors analyzed patients on a case-by-case basis, this work analyzes the physiological progress through the complete CR programme (36 sessions) for all the patients recruited during the study (in addition to the perceptions of the clinicians that were part of the study for 2.5 years). The findings suggest that the robot increases adherence (by 13.3%) and leads to faster programme completion. In addition, the patients assisted by the robot had more rapid improvement in their recovery heart rate, better physical activity performance, and a greater improvement in cardiovascular functioning, which indicates a successful cardiac rehabilitation programme performance. Moreover, the medical staff and the patients acknowledged that the robot improved the patient's motivation and adherence to the programme, supporting its potential in addressing the major challenges. Available here.
- **Hung, L., Liu, C., Woldum, E.** ***et al*****. The benefits of and barriers to using a social robot PARO in care settings: a scoping review.** ***BMC Geriatr*** **19, 232 (2019).** Social robots may serve multiple functions: affective therapy, cognitive training, social facilitator, companionship, and physiological therapy. Specifically, the social robot - PARO (a baby harp seal robot) was designed as pet therapy for older people with dementia. PARO has been commercialized and used in care settings for more than a decade in multiple countries. This review aims to map out the empirical evidence on the key benefits of PARO and identify barriers that may impede the adoption of this social robot. The questions guiding this review are: What has been reported in the literature regarding the benefits of PARO in dementia care? What are the barriers to adopting PARO in the care setting? The study concludes that key benefits include reducing negative emotional and behavioral symptoms, improving social engagement, and promoting positive mood and quality of care experience. While the social robot PARO offers technological opportunities in supporting dementia care and managing difficult behavioral symptoms, the adoption of PARO in care settings remains low. Key barriers to the adoption of the technology include cost and workload, infection concerns, stigma, and ethical issues. Available here.

What do national legislation and international/European treaties and conventions say on the topic?

- **Oyarzabal, R. (2017). What is a Robot under EU Law. The National Law Review. Vol.VII, No 216.** This is an article that briefly and comprehensively describes all the European Commission's initiatives to shape the development of Robots in Europe so far. Furthermore, it outlines the upcoming Legal and Policy Initiatives. One of them is the implementation of safety standards in the health sector. It states that: "The development of medical and assistive technologies is a priority for the Commission, which is increasingly funding research on devices that, for example, promote healthy ageing or help personalize medicines. Both the Parliament and the Commission agree that future medical robots will have to face stringent safety standards. Whilst surgical robots and robotic prostheses are regulated under EU law, care robots (e.g., a robot that takes care of the elderly) may not always be considered a medical device. For example, care robots whose task is to fetch items around the house would be excluded from the medical device regulation. This uncertainty may in some cases pose a problem. As robots become more common, the Commission plans to address these issues and increase regulatory monitoring for medical and care robots, in the line of the new Medical Devices Regulation". Finally, the article refers to the next steps of the European Commission in the fields of robots. Available here.

PRACTICAL COMPONENT

Learning Activities

Activity 1: Socially Assistive Robots

- Watch the video "Socially Assistive Robots" at this address (4.05 minutes).
- Discuss with other students the functionalities of the SAR. The discussion shall give answers to the following questions:
  - How can the SAR help humans in every aspect of their lives?
  - What are the integrated functions of the SAR in the video?
  - What is the role of a bandit robot?
- Resources needed: online video on YouTube; social platform for collaborative learning.
- Duration of activity: 15 minutes,

Activity 2: opinions of health and social care professionals regarding the use of SARs in the care of older people.

- Write down a small paragraph about your opinion on the use of SARs in the care of older people. In which aspects of care do you think assistance robots would help the care of seniors?
- Share your text on the social platform for collaborative learning.
- Resources needed: Word or similar software for writing; social platform for collaborative learning.
- Duration of activity: 15 minutes.

ASSESSMENT COMPONENT

Assessment Activities

Activity 1: Quiz

- Go to the following address and play the short quiz.
- Resources needed: GoConqr, a tool for online Questionnaires; social platform for collaborative learning.
- Post your results on the social platform for collaborative learning.
- Duration: 3 minutes.

EVALUATION COMPONENT

Participants to evaluation

The online evaluation questionnaire of each Learning unit is completed by the MOOC participants (students and student/facilitators) on Survey Monkey

What to evaluate

The Learning Unit's evaluation criteria are: coverage of the identified learning needs, innovation, quality of the content and training materials, intuitive and friendly presentation, relevance of learning activities, and efficiency for achieving established learning outputs.

Please, complete this online evaluation of the learning unit by clicking on this link:

https://www.surveymonkey.com/r/LJCK3DT