Speech and Language Relearning for Stroke Patients-
Understanding User Needs for Technology Enhancement

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Introduction

➢ Stroke is major causes of death and different kinds of chronic disabilities in adults, and **Speech and language** loss is the most common disease for stroke survivors.

➢ The process of **relearning communication** skills is difficult and a time taking process. **Technology-enhanced systems** (TES) can be useful in speech and language relearning, however, the **acceptance** and **usability** of TES for stroke patients have been a matter of concern and more research is needed in this area.

➢ The available software are not explicitly built for recovering **stroke patients' needs** but often for children's learning needs. This paper is, therefore, aimed at **gathering requirements** to support the design of speech and language relearning software applications for stroke survivors.

Speech and language impairments

The basic reason for stroke is a partial or complete stoppage of blood flow to the brain that severely infects the brain function, consequently, the overall human body may face different types of disabilities. Speech and language deficiencies are major part here [1].

[1] https://newsnetwork.mayoclinic.org/discussion/mayo-clinic-q-and-a-speech-therapy-after-a-stroke/

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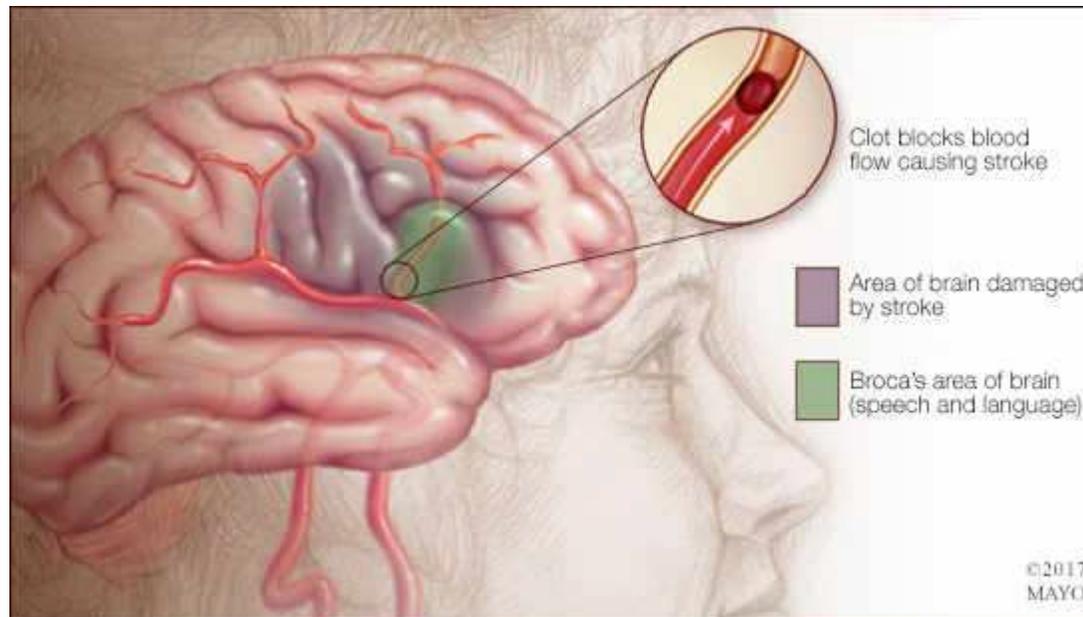
Aim

The study aimed to gather the requirements for designing an interactive speech relearning software application for stroke survivors. The requirements were also considered from the adult learning principles' perspective.

The addressed research questions :

1. What are the requirements for designing an interactive software application for speech relearning exercises following a stroke?

*2. How can the principles of adult learning support understanding the patients' needs?*

Knowles' Adult learning theory

➢ **The adult learning theory** (andragogy) highlights that adults tend to learn differently than traditional children's education that is usually referred to as pedagogy (Knowles et al., 2014).

➢ Knowles suggested that adults should actively participate in the planning, development, and implementation of the learning process (Knowles et al., 2014).

➢ Stroke is most common in adults, however, commonly used speech relearning applications are not developed from an adult's learning perspective. Therefore, adult learning principles should be involved in the requirement identification process.

Andragogy in practice Model

Goals and Purposes for Learning

Individual and Situational Differences

Andragogy:
Core Adult Learning Principles

1. Learners Need to Know
   - why
   - what
   - how
2. Self-Concept of the Learner
   - autonomous
   - self-directing
3. Prior Experience of the Learner
   - resource
   - mental models
4. Readiness to Learn
   - life related
   - developmental task
5. Orientation to Learning
   - problem centered
   - contextual
6. Motivation to Learn
   - intrinsic value
   - personal payoff

Institutional Growth

Subject Matter Differences

Situational Differences

Societal Growth

Individual Learner Differences

Individual Growth

Source: Knowles et al. (2014). The adult learner: The definitive classic in adult education and human resource development, page 80. Routledge

Research Methodology: Design Science
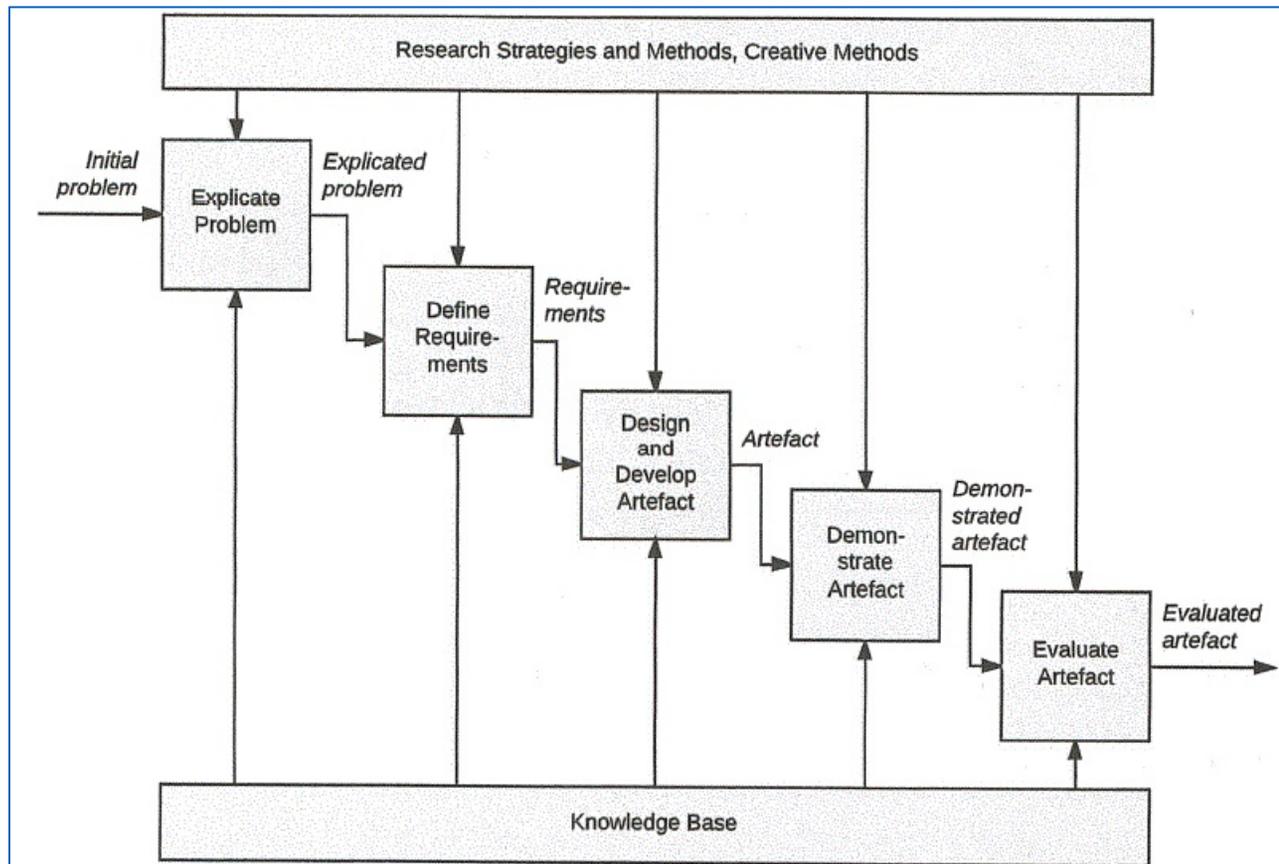
Study Participants

Participants	Professional role	Years of experience
Participant 1	Speech therapist #1, Östersunds Rehabcentrum	25
Participant 2	Speech therapist #2, Östersunds Rehabcentrum	4
Participant 3	Speech therapist #3, Stockholm Rehabcentrum	5
Participant 4	Stroke specialist doctor and manger in the regional hospital	25
Participant 5	Occupational Therapist, Mobile Stroke Team, Regional hospital	5
Participant 6	Physiotherapist #1, Mobile Stroke Team, Regional hospital	8
Participant 7	Physiotherapist #2, Mobile Stroke Team, Regional hospital	3
Participant 8	Chairman of the local stroke patient organization	3
Participant 9	CEO of a small company working with game-based stroke rehabilitation	25
Participant 10	Hardware and software specialist at Microsoft	9
Participant 11	Head of Mobile Stroke Team, Regional hospital	15

Study Findings

The patient's need to know

➢ Involvement of patients from the start while discussing re-learning

➢ Importance of describing the actual situation of patient

➢ Motivation is important while discussing what can be achieved.

➢ For a person involved in managing various situations, such as being a politician or chairman, is speech of specific interest to continue activities conducted before the stroke as much as possible.

➢ Therefore, the patients need to know what they can do to live their lives as much as possible as before the stroke.

Study Findings

Establishing learning objectives

➤ Learning objectives should be defined after **an assessment of patient's physical and cognitive condition.**

➤ The assessment relies on an analogue procedure, developed and used in Sweden by speech therapists, and is commonly used throughout the country. Both speech therapists are keen on converting the analogue assessment process into **an interactive speech and language assessment application**, where the results would easily be stored and used as input for the re-learning assignments.

Study Findings

Readiness to learn

After designing the learning strategy and tools, the patients should be prepared for the implementation of the learning strategy. Proper **education** and **training**, **usability considerations**, and **social aspects** of TES might increase the readiness to learn for patients. Almost all the participants emphasized the importance of technology acceptance requirements such as **usefulness**, **ease of use**, **adaptability**, and **satisfaction** of the application

Study Findings

➢ **The intensity of relearning exercises:** Less intensive exercises
  showed more improvement than highly intensive exercises.

➢ **Possibility of social networking**: A feature in the software
  application that provides the involvement of friends and family.

➢ **Native language:** The software application should be in the Swedish
  language.

➢ **Patient's Medical condition VS selection of relearning exercises**

Study Findings

- **Involvement of medical caregivers and stroke patients in the design process**

- **Technical assistance and training:** Not only the application should be interactive and easy to use by itself, the process of training and education of using the application should also be **interactive**, **user-centered**, and in the **native language**.

- **Medical assistance and education:** A proper education and assistance about stroke rehabilitation is essential for the **patients** and their **close relatives**.

Study Findings

- **Selection of hardware**: A **larger screen size** than a smartphone like **a tablet or desktop computer** will be more appropriate for patients with aphasia spatially for older adults.

- **Graphical interface:** The interface should be adjusted according to stroke patients' needs. For example, typography size should be bigger than usual and the background should be simple to avoid distraction. Ideally, the font size should be adjustable and the background themes should be changeable. Moreover, the colors should be more contrastive between selected and unselected items on the screen.

Conclusion

Despite their impaired medical condition, stroke patients tend to use TES for speech and language relearning.

The study findings indicate that **independent living**, **treatment in the home environment**, and improved **quality of life** are the major motivational factors for the use of TES.

The usability factors of software and hardware such **as customized graphical user interface** and bigger size of hardware screen are vital for the acceptance of TES.

Proper **education of technical and medical aspects** of the software are also important for higher user acceptance.

Future Work

This study found essential **requirements** for the future development of technology-enhanced applications for speech and language relearning tailored for stroke patients. The next planned steps are to **design**, **develop**, and **evaluate** technology-enhanced application to support the diagnosis and the relearning process after stroke. Both these applications should be designed and tested with a multi-stakeholder approach involving caregivers, software developers, stroke patients, and stroke patients' friends and family. To carry out the work with a multi-stakeholder approach is essential since a stroke patient's speech relearning journey back to an independent life is a long and tedious one.

Speech and Language Assessments Application

Step 1: Patient's information

Speech and language Assessments Application

Step 2: Patient's speech and language impairment diagnosis

Speech and language Assessments Application

Step 3: Patient's speech and language impairment evaluation
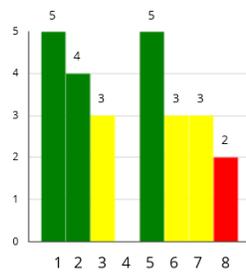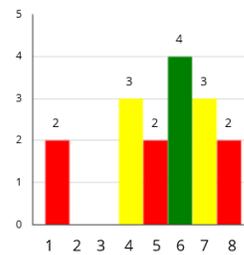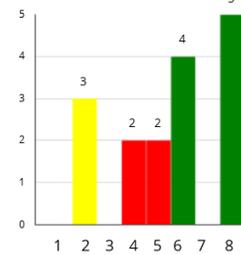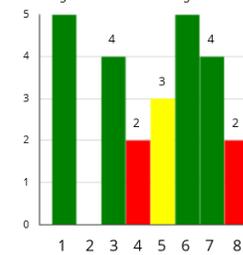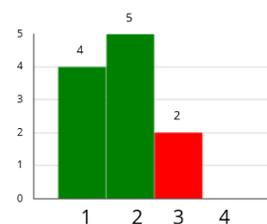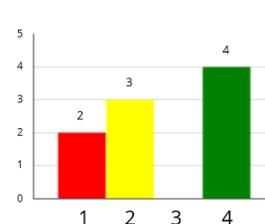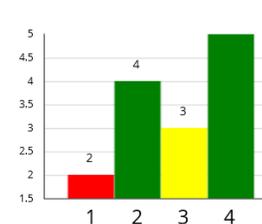
Speech and language assessments Application- Patients' Interface
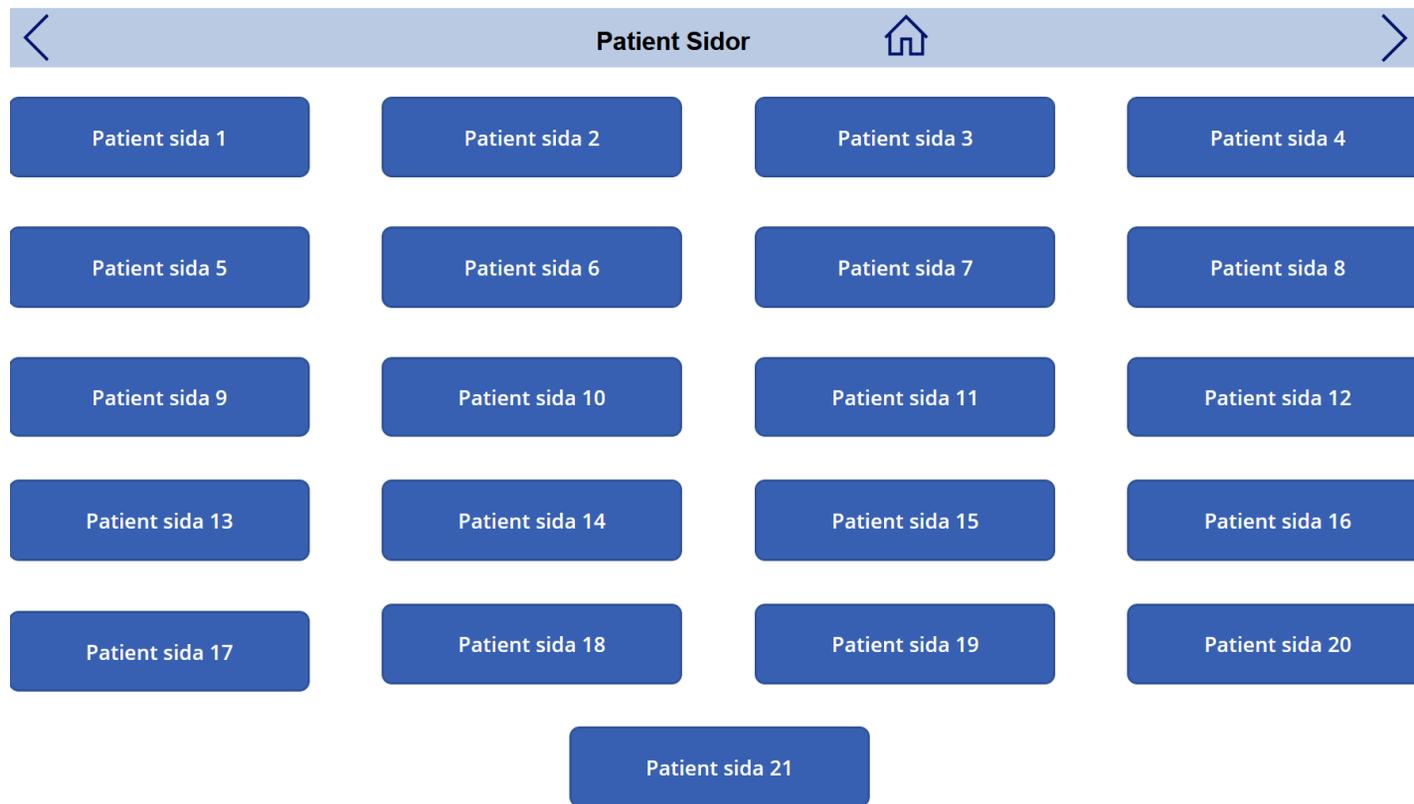
THANK YOU
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