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

eTELEMED 2021

Awais Ahmad
Lecturer in Computer Science | e-Health Researcher | Internationalization coordinator
Department of Computer and Systems Sciences
Campus Östersund
Mid Sweden University Sweden
Introduction

- Stroke is a major cause 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].

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

Research Methodology: Design Science
# Study Participants

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

Ny Patient
- Fornamn
- Efternamn
- Personnummer
- Logoped
- Afasitex pågår
  - På

Alla Befintliga Patienter
- Erik Ström
  - 02/11/2020 22:22
- Anna Persson
  - 02/11/2020 15:43
- Awa Al Ahmad
  - 02/11/2020 22:49

Översikt
- Fornamn
- Efternamn
- Personnummer
- Logoped
- Afasitex pågår
- På

TESTPOÅNG
<table>
<thead>
<tr>
<th>TOTALT</th>
<th>MEDEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>116</td>
<td>3.2222...</td>
</tr>
</tbody>
</table>
## Speech and language Assessments Application

### Step 2: Patient’s speech and language impairment diagnosis

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A1. Namn, adress, ålder</strong></td>
<td>A1.0</td>
<td>A1.1</td>
</tr>
<tr>
<td><strong>A2. Benämning av bil...</strong></td>
<td>A2.0</td>
<td>A2.1</td>
</tr>
<tr>
<td><strong>A3. Benämning efter...</strong></td>
<td>A3.0</td>
<td>A3.1</td>
</tr>
<tr>
<td><strong>A4. Satskomplettering</strong></td>
<td>A4.0</td>
<td>A4.1</td>
</tr>
<tr>
<td><strong>A5. Automatiserade...</strong></td>
<td>A5.0</td>
<td>A5.1</td>
</tr>
<tr>
<td><strong>A6. Meningar</strong></td>
<td>A6.0</td>
<td>A6.1</td>
</tr>
<tr>
<td><strong>A7. Beskrivande tal...</strong></td>
<td>A7.0</td>
<td>A7.1</td>
</tr>
<tr>
<td><strong>A8. Berättande tal...</strong></td>
<td>A8.0</td>
<td>A8.1</td>
</tr>
<tr>
<td><strong>B1. Bokstäver</strong></td>
<td>B1.0</td>
<td>B1.1</td>
</tr>
<tr>
<td><strong>B2. Bokstavsekvenser</strong></td>
<td>B2.0</td>
<td>B2.1</td>
</tr>
<tr>
<td><strong>B3. Nörnsensstavelser</strong></td>
<td>B3.0</td>
<td>B3.1</td>
</tr>
<tr>
<td><strong>B4. Ord</strong></td>
<td>B4.0</td>
<td>B4.1</td>
</tr>
<tr>
<td><strong>B5. Ordsekvenser</strong></td>
<td>B5.0</td>
<td>B5.1</td>
</tr>
<tr>
<td><strong>B6. Ordpär</strong></td>
<td>B6.0</td>
<td>B6.1</td>
</tr>
</tbody>
</table>

**Examples:**
- **A1:** Av
- **A2:** På
- **A3:** På
- **A4:** Av
- **A5:** På
- **A6:** På
- **A7:** På
- **A8:** På
- **B1:** Av
- **B2:** Av
- **B3:** Av
- **B4:** På
- **B5:** På
- **B6:** Av
Speech and language Assessments Application

Step 3: Patient’s speech and language impairment evaluation

**A-ning ÖVERSIKT-SPRÅKLIG FÖRMÅGA**

- **A. INFORMATIVT TAL**
  - Medelpoäng: 3.57
  - Diagram shows scores for different categories.

- **B. REPETITION**
  - Medelpoäng: 2.4
  - Diagram shows scores for different categories.

- **C. HÖRFÖRståELSE**
  - Medelpoäng: 2.6
  - Diagram shows scores for different categories.

- **D. LÄSFÖRståELSE**
  - Medelpoäng: 3.571
  - Diagram shows scores for different categories.

- **E. HÖGLÄSNING**
  - Medelpoäng: 3.6666
  - Diagram shows scores for different categories.

- **F. DIKTAMEN**
  - Medelpoäng: 2.25
  - Diagram shows scores for different categories.

- **G. INFORMATIV SKRIFT**
  - Medelpoäng: 4.5
  - Diagram shows scores for different categories.

**TESTPOÅNG**

<table>
<thead>
<tr>
<th>TOTAL</th>
<th>MEDEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>116</td>
<td>3.2222</td>
</tr>
</tbody>
</table>

Mittuniversitetet
Speech and language assessments Application - Patients’ Interface
THANK YOU
Email: awais.Ahmad@miun.se

Awais Ahmad
Lecturer in Computer Science | e-Health Researcher | Internationalization coordinator
Department of Computer and Systems Sciences
Campus Östersund
Mid Sweden University Sweden