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**ASPECTS SUPPORTING AND HINDERING TYPE 2 DIABETES
SELF-MANAGEMENT IN WEB-BASED EDUCATIONAL
PORTALS: USABILITY TESTING STUDY WITH UPDATED
FRAMEWORK IN RAZAVI-KHORASAN, IRAN**

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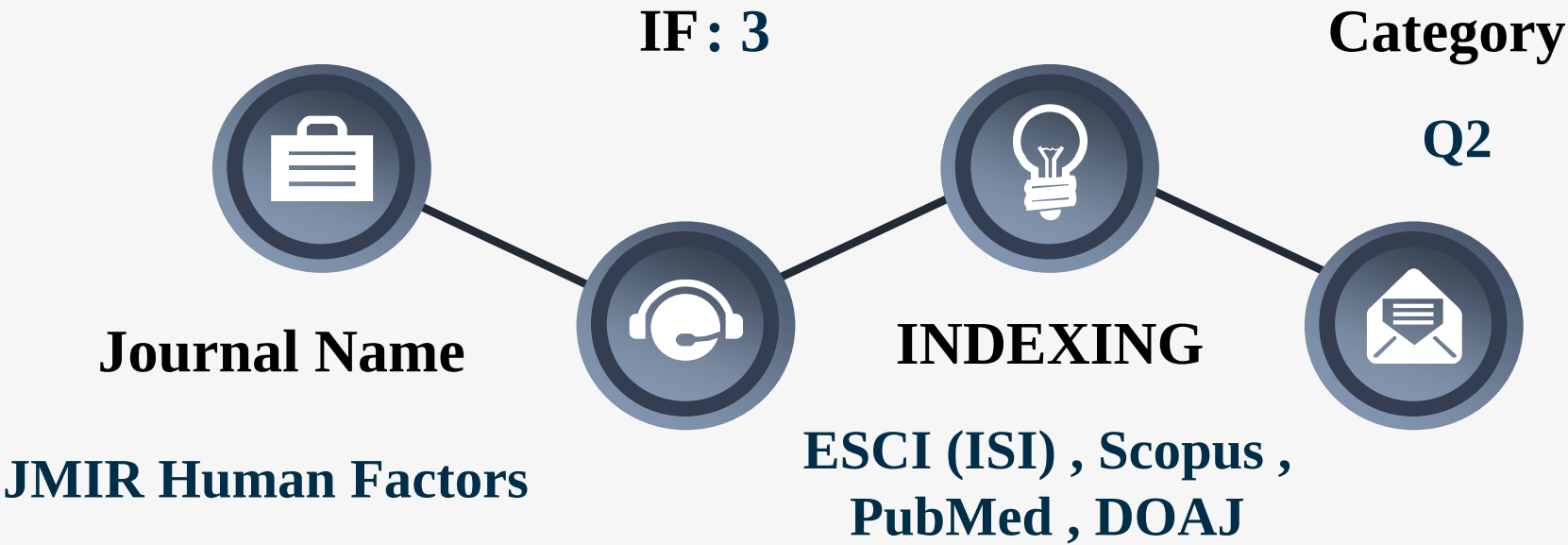
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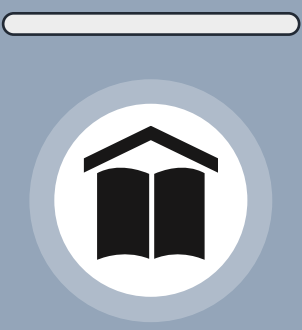
Journal Information



Introduction



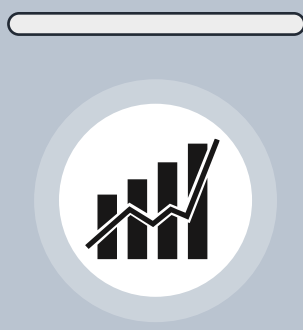
Study Aim



Methods



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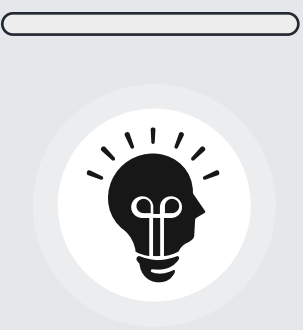


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Discussion and Conclusion



My Perspective





Abbreviations

QoL	Quality of Life
T2D	Type 2 diabetes
eHealth	Electronic Health

Introduction





Introduction



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❖ Diabetes: one of the most important chronic diseases worldwide

❖ Global statistics

1990 —————> ~ 200 million people

2022 —————> ~ 830 million people

❖ ~ 90 of diabetes cases : **T2D**

❖ Main challenge in Diabetes : No definitive cure

Focus on : **preventing complications – patient education – empowering self-management**

❖ **Self-care** : Focuses on prevention of disease and maintenance of well-being

❖ **Self-management** : Focuses on coping with the disease and controlling clinical parameters





Introduction

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- ❖ Increased internet & smartphone access

Development of : **Health apps - Patient portals - Online educational websites**

- ❖ Advantages of web-based systems:

- ✓ Easy access
- ✓ Lower cost
- ✓ Use anytime, anywhere
- ✓ Quick access to education

- ❖ Iran's population using the internet

➤ 2012: ~53% ➤ 2022: ~82%

- ❖ Computer literacy

Basic computer skills (save files, use software, send emails)

- ❖ eHealth literacy

Ability to search, find, understand, evaluate health information from online sources





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Introduction

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Designing Self-Management Systems

- ❖ Systems should provide:
 - ✓ Educational content
 - ✓ Health data entry
 - ✓ Communication with physicians
- ❖ Design challenges
 - ✓ Complex user interface
 - ✓ User literacy levels
 - ✓ Information security



QoL and Design Trade-offs

WHO definition of **QoL** : Individual's perception of their position in life within the context of culture and value systems

Trade-off: losing one aspect in exchange for gaining another

Designers must explore **QoL** and act in the best interests of all stakeholders



Necessity of understanding technology's strengths and weaknesses to achieve the goal

Analysis of designing trade-offs in heart failure self-management improves understanding of self-management technologies

Similar analysis is needed for T2D





Designing Web-Based Educational Portals

Online tool for interacting with healthcare systems and providers, following treatment, and promoting preventive measures

Usability

Extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use

Usability testing

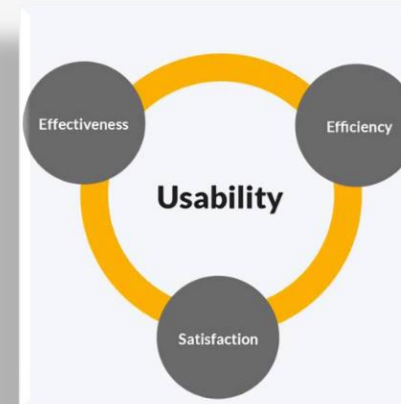
Testing products/websites with participants from the target population

Role of usability testing

Evaluating basic usability criteria while participants perform representative tasks

Effectiveness of usability testing

Identifying barriers and system design issues



Study Aim





Study Aim



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Developing a framework of design principles for T2D self-management tools

Investigating usability problems of a web-based educational portal

Updating the design framework based on usability test results



Methods



Ethical considerations

- Oral and written information provided to participants
- Signed informed consent form
- Informed about data usage, anonymity, right to withdraw at any time without explanation
- No compensation received
- Approval by Ethics Committee of Mashhad University of Medical Sciences





Approach to Identifying Design Principles for Diabetes Self-Management

- ❖ Analysis of authors' previous work and related literature
- ❖ Designing portal for the local context of Razavi-Khorasan
- ❖ Mapping of portal functionalities to 5 layers of influence from the Ecological Model of Health Behavior :
 - **Intrapersonal** ➤ **Interpersonal** ➤ **Organizational** ➤ **Community** ➤ **Public policy**
- ❖ Structured consensus-based approach :
Iterative expert panel discussions among authors + synthesis of evidence

Output: Set of design principles for web portals that facilitate effective diabetes self-management



- Use of terminology and checklist from Martins et al
- Usability assessment moderator (had prior experience, external to development team)
Moderator role: Sitting beside participant, encouraging verbalization, assisting when needed
- **Sample size:** 10 participants (based on Faulkner, 2003: 10 users → identifies 95% of problems)
- **Sampling method:** Convenience sampling from Mashhad Diabetes Clinic



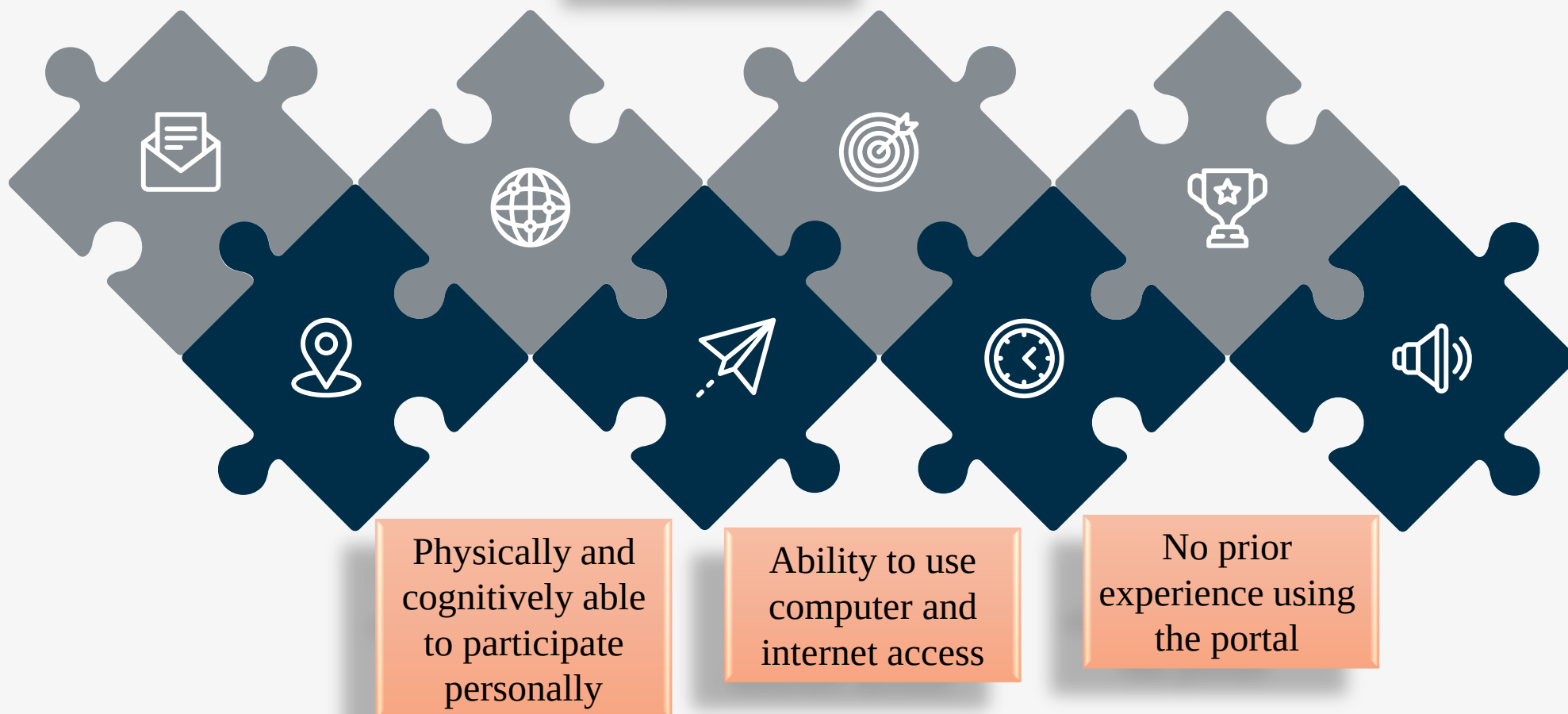
Inclusion criteria

T2D diagnosis > 1 year prior to this study

No serious diabetes complications

9 years of formal education

Willingness to participate





Usability Testing Method

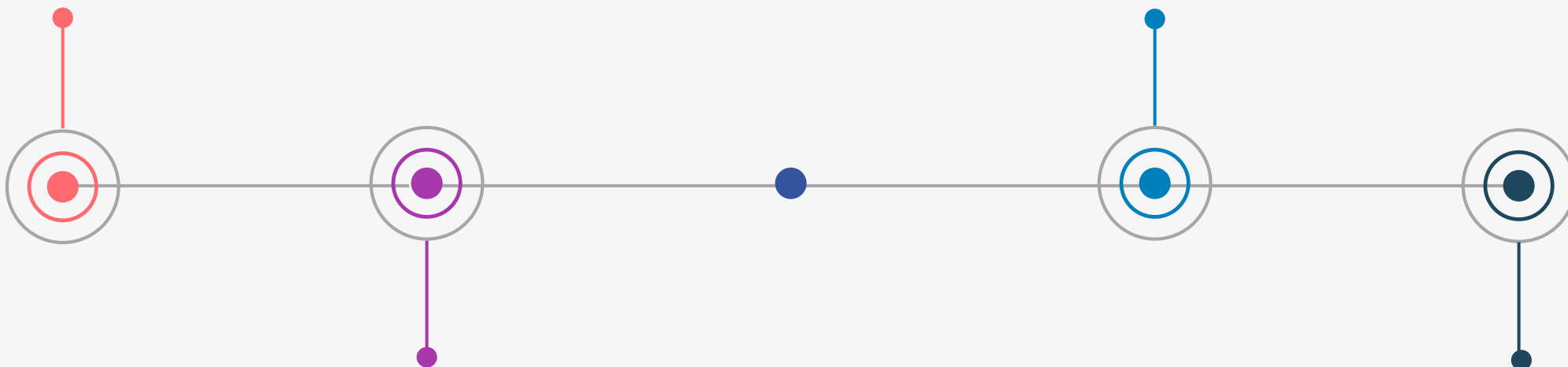
Single usability testing method with concurrent think-aloud technique

Supplemented with screen and interaction logging (clicks, navigation paths, errors)

Verbatim transcription into Persian

Audio recording using laptop's built-in microphone

Screen recording using Camtasia Studio version 8.4





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Methods

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9 tasks corresponding to 9 portal sections

Table 1. The 9 tasks and their explanations, including the collected data or material.

Task name	Task explanation
Fill in patient information	The user is asked to type or select from a drop-down list. The data are entered into the system using the keyboard and mouse. They include name and surname, gender, age, education level, occupation, address, weight, height, type of diabetes, age of onset of diabetes, and associated specific disease.
Register laboratory results	The user is asked to type laboratory result values and read medical documentation. FBS ^a , 2hpp ^b , 5PM ^c , HbA1c ^d , liver function tests (SGOT ^e , SGPT ^f , ALP ^g), lipids profile (cholesterol and triglyceride), kidney function tests, urine sugar, BUN ^h , creatinine, and blood pressure.
Attending educational courses	The user is asked to attend a course aiming to help them improve their diabetes self-management. Eight courses are available, and they were asked to attend one of these courses. Each course contains a short quiz, which is answered before beginning the course.
Read educational material	The user is asked to read educational material about various aspects of diabetes and its effects on organs and the relationship between stress, physical activity, drugs, and disease progression.
Use the “help-me” steps	The user is asked to follow the “help-me” flow or to follow sequential steps to access specific information.
Check health improvement	The user is asked to access data about their current situation based on their medical condition and the laboratory results recorded in the medical record.
Play educational movies	The user is asked to find and watch one short movie about diabetes for at least 1 minute, regarding diabetes complications, diets tailored for patients with diabetes, or other related subjects. Movies are about 3 to 4 minutes long.
Calculate health indices	The user is asked to use a food calorie counter and a calculator to check the BMI and the glycemic index of different types of food. The task was composed of one calculation based on the user's interest.
Chat with physicians and nurses	The user is asked to use the chat to communicate with physicians or nurses.

Data Analysis

- ❖ **Quantitative**: Calculation of time on task
- ❖ **Qualitative**: Qualitative content analysis based on think-aloud verbalizations and moderator notes

Severity rating of usability problems

- 0 : not a usability problem
- 1 : cosmetic problem only
- 2 : minor usability problem
- 3 : major usability problem
- 4 : usability catastrophe

- ❖ Factors: frequency, impact, persistence



Results



Participant Characteristics

- 1** Number: 10 patients (5 male, 5 female) 
- 2** Mean age: 46.5 years (SD 6.4) 
- 3** Mean disease duration: 7.9 years (SD 4.5) 
- 4** Education level: 7 (undergraduate) and 3 (postgraduate) 



Table 2. Duration of task completion for each user.

	Task 1—Fill in patient information		Task 2—Register laboratory results		Task 3—Attending educational courses		Task 4—Read educational material		Task 5—Use the “Help-me” steps		Task 6—Check health improvement		Task 7—Play educational movies		Task 8—Calculate health indexes		Task 9—Chat with physicians and nurses		Test duration	
	Value (s)	%	Value (s)	%	Value (s)	%	Value (s)	%	Value (s)	%	Value (s)	%	Value (s)	%	Value (s)	%	Value (s)	%	Value (s)	%
Participant A	610	28.6	460	21.6	270	12.7	30	1.4	200	9.4	90	4.2	120	5.6	210	9.9	140	6.6	2130	100
Participant B	330	15.5	440	20.7	210	9.9	30	1.4	220	10.3	100	4.7	150	7.0	470	22.1	180	8.5	2130	100
Participant C	510	25.6	450	22.6	240	12.1	50	2.5	95	4.8	90	4.5	105	5.3	300	15.1	150	7.5	1990	100
Participant D	390	20.4	480	25.1	200	10.5	60	3.1	240	12.6	60	3.1	90	4.7	300	15.7	90	4.7	1910	100
Participant E	570	22.5	470	18.5	310	12.2	275	10.8	280	11.0	60	2.4	80	3.2	390	15.4	100	3.9	2535	100
Participant F	630	36.5	405	23.5	90	5.2	45	2.6	60	3.5	85	4.9	60	3.5	220	12.8	130	7.5	1725	100
Participant G	490	25.5	420	21.9	230	12.0	50	2.6	250	13.0	60	3.1	80	4.2	190	9.9	150	7.8	1920	100
Participant H	760	35.8	480	22.6	230	10.8	80	3.8	160	7.5	70	3.3	110	5.2	140	6.6	90	4.2	2120	100
Participant I	400	19.5	380	18.5	270	13.1	90	4.4	120	5.8	85	4.1	110	5.4	480	23.4	120	5.8	2055	100
Participant J	440	20.4	435	20.1	195	9.0	200	9.3	380	17.6	120	5.6	110	5.1	180	8.3	100	4.6	2160	100
Time																				
Average	513	25.0	442	21.0	224.5	11.0	91	4.0	200.5	10.0	82	4.0	101.5	5.0	288	14.0	125	6.0	2068	—
SD	131.1	— ^a	33.0	—	59.2	—	81.5	—	95.4	—	19.7	—	25.2	—	122.3	—	30.3	—	—	—
																			212.8	
Range	330-760	—	380-480	—	90-310	—	30-275	—	60-380	—	60-120	—	60-150	—	140-480	—	90-180	—	1725 - 2535	—
Range width	430	—	100	—	220	—	245	—	320	—	60	—	90	—	340	—	90	—	810	—

^aNot applicable.

Number and Severity of Usability Problems

Table 3. Usability problems were identified by users in terms of tasks and their severity ratings.

Tasks	Severity, n (%)					Total usability problems per task, n (%)
	0	1	2	3	4	
Fill in patient information	8 (21)	10 (26)	10 (26)	6 (16)	4 (11)	38 (34)
Register laboratory results	4 (15)	4 (15)	14 (52)	2 (7)	3 (11)	27 (24)
Attending educational courses	1 (20)	1 (20)	1 (20)	2 (40)	0	5 (4)
Read educational material	0	3 (100)	0	0	0	3 (3)
Use the “Help-me” steps	0	0	3 (75)	1 (25)	0	4 (4)
Check health improvement	0	0	0	0	2 (100)	2 (2)
Play educational movies	0	0	3 (75)	1 (25)	0	4 (4)
Calculate health indexes	0	1 (8)	7 (59)	3 (25)	1 (8)	12 (11)
Chat with physicians and nurses	1 (6)	5 (31)	8 (50)	2 (13)	0	16 (14)
Total usability problems	14 (13)	24 (22)	46 (41)	17 (15)	10 (9)	111 (100)



Results

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Specific Problems

- Understanding medical terminology
- All laboratory items in English
- Navigation problems
- Too small font size
- Slow scrolling
- Complicated registration and login process
- Problems entering laboratory test results





Results

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Qualitative feedback

Satisfaction with ability to perform tasks without others' help

Appreciation of educational content and help with solving problems

Importance of chat with physicians and nurses

Helpful step-by-step instructions



Table 4. Suggestions for the improvement of the portal.

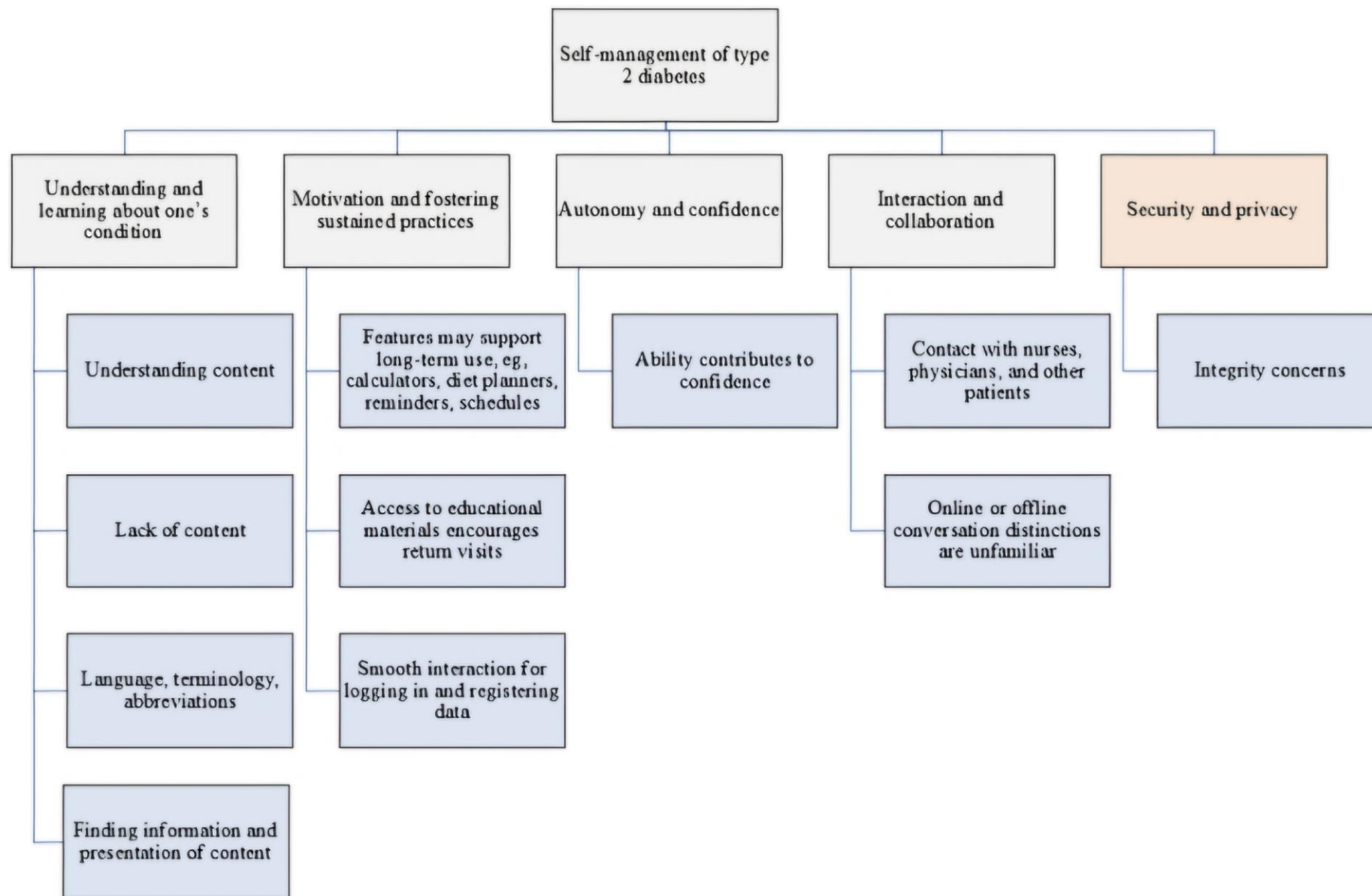
User suggestions	Frequencies, n (%)
Need to have a user guide or guideline for the portal	9 (19.1)
Use appropriate messages to interact with the user	8 (17.0)
Embed the list of physicians and nurses in the online chat	5 (10.6)
Use of larger font and readable colors	5 (10.6)
Mark clearly mandatory fields	3 (6.4)
Add more educational content	3 (6.4)
Offer a diet plan	3 (6.4)
Change the titles of the calculator option	2 (4.3)
Do not use medical terms or jargon	2 (4.3)
Classify the content according to patients' literacy level	1 (2.1)
List specific diseases that a user can select from a list	1 (2.1)
Complete the educational courses	1 (2.1)
Use more pictures and graphs in the educational materials	1 (2.1)
Use simple options to calculate BMI	1 (2.1)
Use more simple options to calculate calories	1 (2.1)
Add an option for booking time to see their physician	1 (2.1)



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Results

Figure 3. The updated framework.



Discussion and Conclusion





Conclusion and Discussion

- Even with complete content, **usability problems** can prevent effective use
- 111 usability problems identified → shows **real-user evaluation is Essential**
- Main barriers:
 - ❖ Complex medical terminology
 - ❖ English lab test names
 - ❖ Complicated data entry
 - ❖ Poor visual design (small font)
- Health systems must be designed based on **actual user needs**, not just **expert views**





Importance of eHealth literacy & user experience

- Many patients may:
 - ✓ Have limited experience using computers
 - ✓ Be unfamiliar with medical terminology
 - ✓ Have difficulty understanding health information
- Design should:
 - ❖ Simplify complex medical information
 - ❖ Use visuals (graphs, videos)
 - ❖ Provide simple, understandable user paths
- Balance between information amount and user's cognitive load
- Too much data entry or complex steps → user fatigue → reduced use



Key Strengths



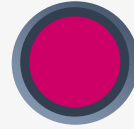
First in Iran: Presenting a design framework for T2D self-management portals

Real patient evaluation: Identifying usability problems using the think-aloud method

Uncovering hidden needs: Adding the privacy and security principle directly based on patient voices



Limitations



Framework foundation: Based only on authors' previous literature → Other principles may exist

Sampling: Only patients from one clinic in Mashhad → Limited generalizability to other regions

Task coverage: Focus on specific tasks within 9 sections → Cross-section interactions may be overlooked





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Discussion and Conclusion



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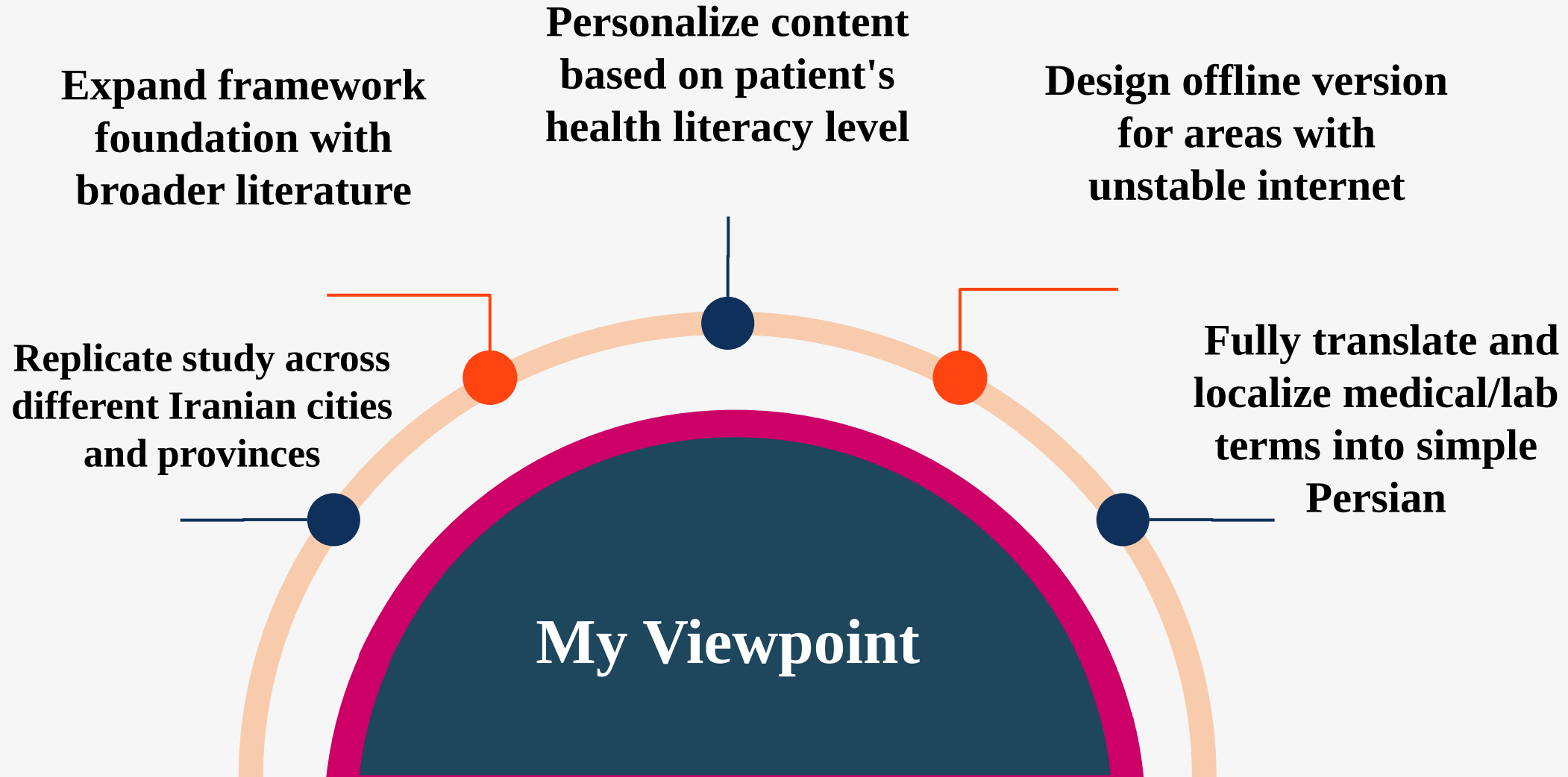
- ✓ An educational portal designed based on 5 principles (understanding, motivation, autonomy, interaction, security) → effectively supports self-management and is well received by patients.
- ✓ Three risks that undermine sustained use:
 - ❖ Poor interactions (confusing navigation, unintuitive interface)
 - ❖ Complex language (technical jargon) → reduced comprehension and discouragement
 - ❖ Lack of data security → loss of trust and system abandonment

Usability testing, despite being time-consuming, is essential and irreplaceable for evaluating a portal and ensuring long-term patient use.



My Perspective





An aerial photograph of a city, likely Hong Kong, showing a dense urban landscape with numerous buildings and green spaces. A large, tilted white rectangle with a dark blue border is superimposed over the center of the image. Inside this rectangle, the text "Thanks for your attention" is written in a black serif font. At the bottom left of the white rectangle, there are three small black icons: a house, a left-pointing arrow, and a right-pointing arrow.

Thanks for your attention

