

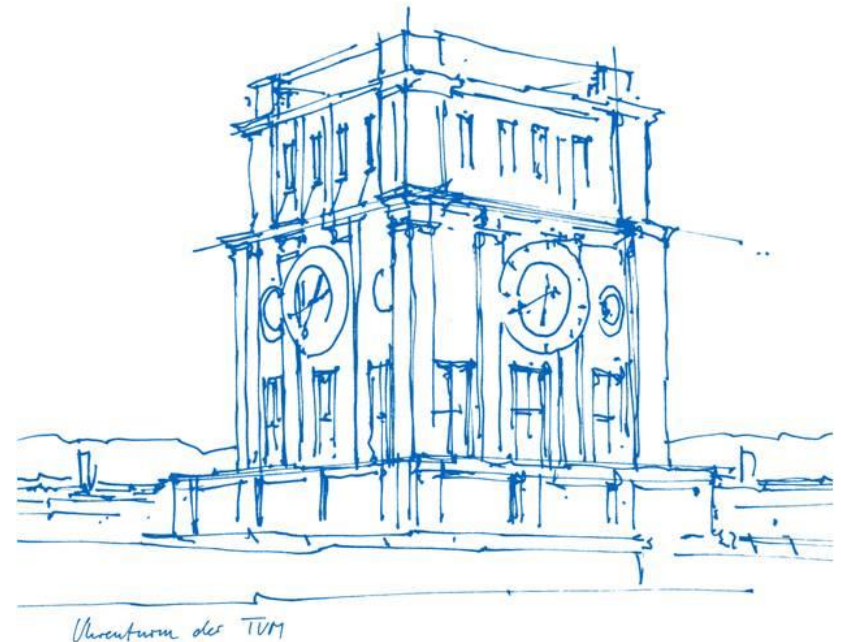
Supporting Actionable Knowledge: A Conversational AI Chat Assistant for Dietary Monitoring

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Outline

1. Introduction and Motivation
2. Theoretical Background
3. RAINA
4. Evaluation
5. Results
6. Future Work
7. Conclusion

Introduction and Motivation

- 1.9 billion overweight adults in 2016
- Overweight and obesity pose a high health risk
 - Cardiovascular diseases
 - Type 2 diabetes
 - Increased possibility for severe course of infectious diseases
- Main reasons for overweight: unhealthy diet and lack in physical activity
- Changing behavior in diet and exercise is a long-term process
- Goal: develop a chat assistant to support implementing and monitoring a healthy diet

Theoretical Background

BZfE Nutrition Pyramid



retrieved from: <https://www.bzfe.de/ernaehrung/die-ernaehrungspyramide/die-ernaehrungspyramide-eine-fuer-alle>
(accessed: 08.01.2022)

- Each field represents one serving of the corresponding food group
- Size of servings is measure with a person's hands → fits to all ages and sizes
- Fruits, vegetables and carbohydrates:
 - Volume of both hands as a “bowl”
- Bread, cheese and extras:
 - Area of one hand with fingers
- Meat and fish:
 - palm of one hand
- Water, juices and milk:
 - one glass

RAINA – Realtime Artificial Intelligent Nutrition Assistant



Evaluation



Pre-study Questionnaire

Health Consciousness
 Reflective Thinking
 Nutrition Self-Efficacy
 Nutrition Assessment

Testing Period

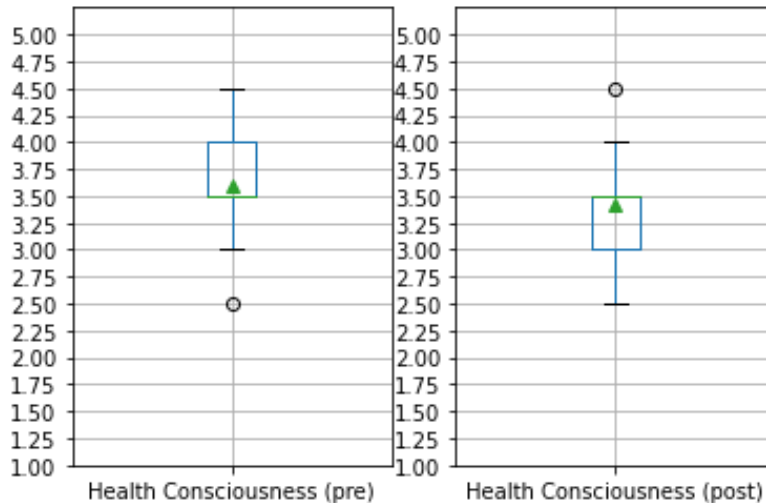
Seven days
 Interacting with RAINA
 Using the Nutrition Pyramid

Post-study Questionnaire

Health Consciousness
 Reflective Thinking
 Nutrition Self-Efficacy
 Questions about RAINA

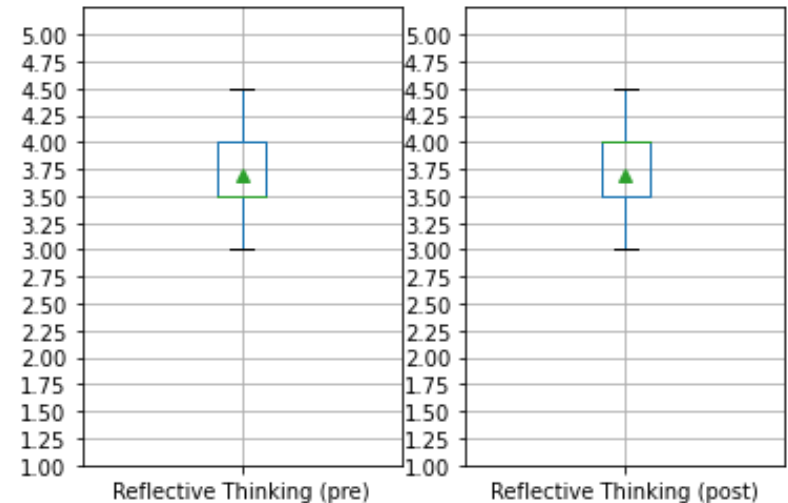
Results

Health Consciousness, Reflective Thinking



Health Consciousness

- Pre: (M=3.59, SD=0.46)
- Post: (M=3.42, SD=0.49)

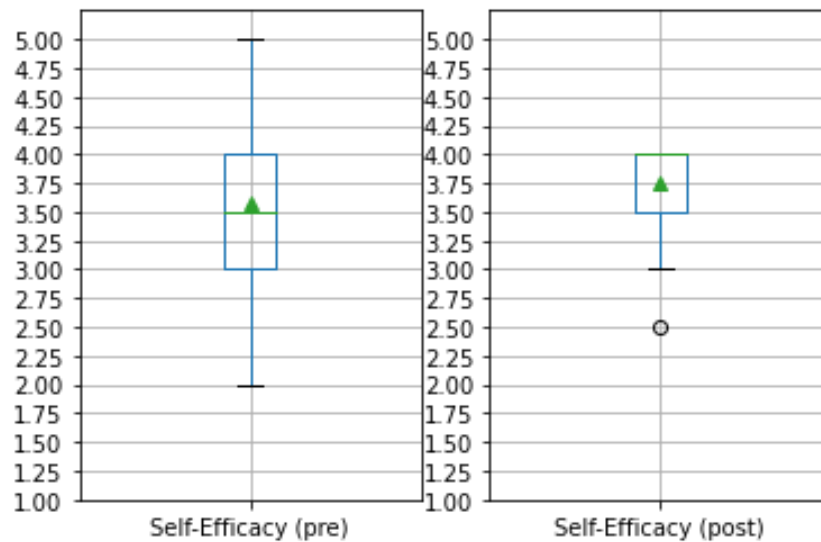


Reflective Thinking

- Pre: (M=3.690, SD=0.40)
- Post: (M=3.694, SD=0.46)

Results

Nutrition Self-Efficacy



Nutrition Self-Efficacy

- Pre: (M=3.57, SD=0.75)
- Post: (M=3.75, SD=0.43)

Results

General Observations

- 61% of the participants knew the Nutrition Pyramid before study
- Majority had to adapt their diet to match the recommendations
- Approach of tracking servings was perceived well
- Nutrition Pyramid helped to get an overview over their diet
- Nutrition Pyramid not applicable for vegan diet and professional athletes



Future Work

- RAINA
 - Add “Recipes” for faster adding of recurring dishes
 - Add “Nutrition Score” to pyramids in evening/weekly check-in
- Follow-up Study
 - Participants with lower Health Consciousness, Reflective Thinking and Self-Efficacy
 - Observe impact when supporting long-term behavior change

Conclusion

- BZfE Nutrition Pyramid easy to understand and to keep in mind
- Positive feedback regarding a coarse diet tracking and monitoring approach
- RAINA well perceived, but needs refinements for further studies
- No significant changes in Health Consciousness, Reflective Thinking and Self-Efficacy
 - Participants had good scores before the testing period
 - Missing questionnaires and usage affect the results
- Further studies required to observe impact on long-term Behavior Change

Sources

World Health Organization (2013). *Obesity: Health consequences of being overweight*. url: <https://www.who.int/news-room/q-a-detail/obesity-health-consequencesof-being-overweight>. (01.02.2022).

World Obesity Federation (2021). *COVID-19 and Obesity: The 2021 Atlas*. Report. World Obesity Federation.

Brüggemann, I. (2018). *Die Ernährungspyramide - Richtig essen lehren und lernen*. Pamphlet.

BZfE (2021). *Ernährungspyramide: Was esse ich?* url: <https://www.bzfe.de/ernaehrung/die-ernaehrungspyramide/die-ernaehrungspyramide-eine-fuer-alle/ernaehrungspyramide-was-esse-ich/>. (accessed: 09.01.2022).

Hong, H. (2009). "Scale development for measuring health consciousness: Reconceptualization." In: *that Matters to the Practice*, p. 212.

Kember, D., D. Y. P. Leung, A. Jones, A. Y. Loke, J. McKay, K. Sinclair, H. Tse, C. Webb, F. K. Yuet Wong, M. Wong, and E. Yeung (2000). "Development of a Questionnaire to Measure the Level of Reflective Thinking." In: *Assessment & Evaluation in Higher Education* 25.4, pp. 381–395. issn: 0260-2938. doi: 10.1080/713611442.

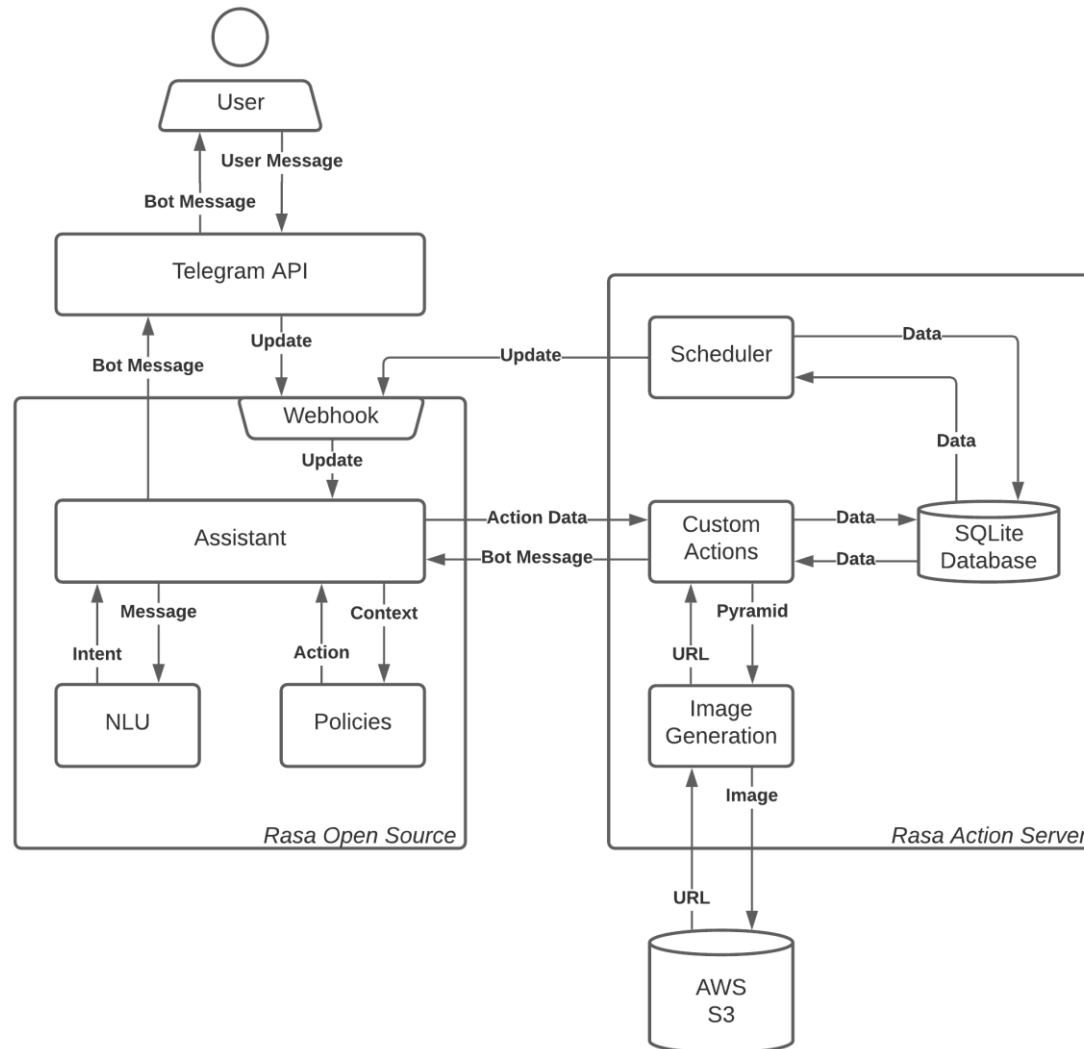
Schwarzer, R. and B. Renner (2009). "Health-Specific Self-Efficacy Scales."

Shamsalinia, A., R. Ghadimi, R. T. Chafjiri, F. Norouzinejad, A. Pourhabib, and F. Ghaffari (2019). "Nutrition self-efficacy assessment: designing and psychometric evaluation in a community-dwelling elderly population." In: *Journal of Health, Population and Nutrition* 38.1. issn: 2072-1315. doi: 10.1186/s41043-019-0203-3.

Kocielnik, R., L. Xiao, D. Avrahami, and G. Hsieh (2018). "Reflection Companion." In: *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 2.2, pp. 1–26. issn: 2474-9567. doi: 10.1145/3214273.

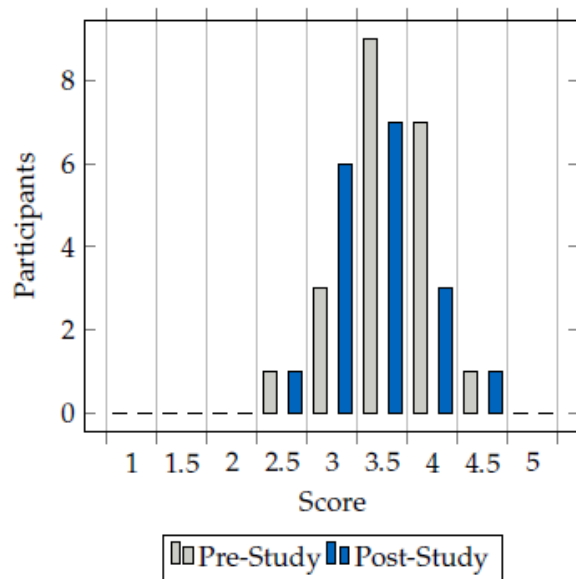
Appendix

System Architecture



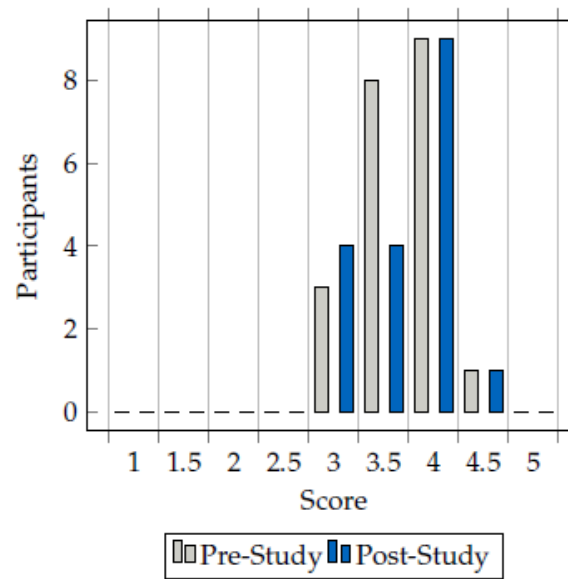
Results

Health Consciousness, Reflective Thinking, Nutrition Self-Efficacy



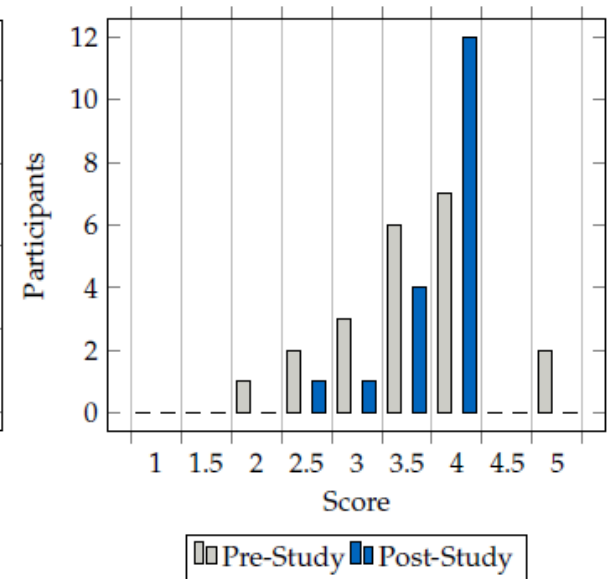
Health Consciousness

- Pre: (M=3.59, SD=0.46)
- Post: (M=3.42, SD=0.49)



Reflective Thinking

- Pre: (M=3.690, SD=0.40)
- Post: (M=3.694, SD=0.46)

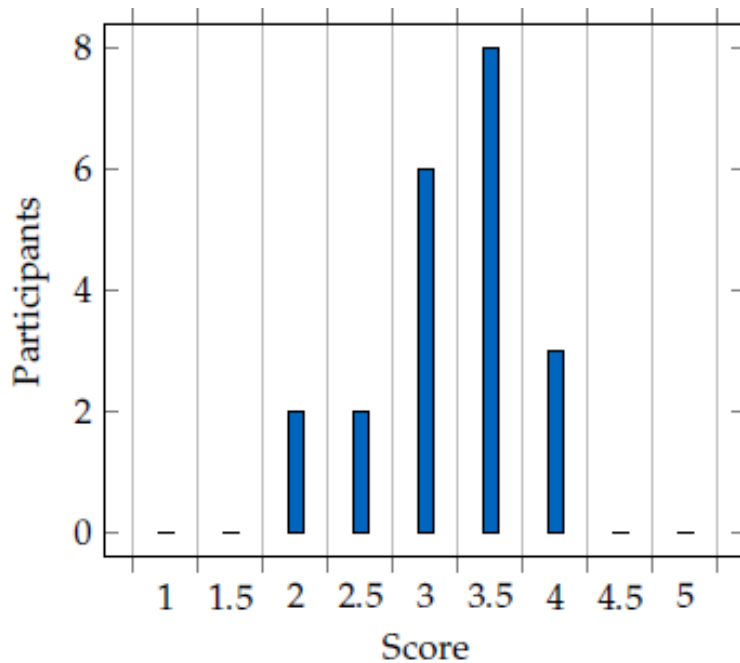


Nutrition Self-Efficacy

- Pre: (M=3.57, SD=0.75)
- Post: (M=3.75, SD=0.43)

Results

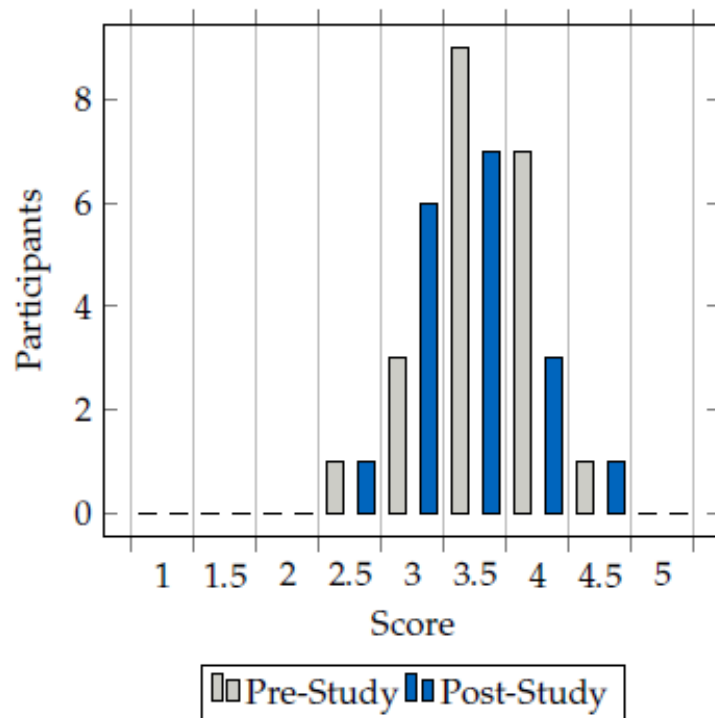
Nutrition Assessment



- Only asked in Pre-Study Questionnaire
- (M=3.19, SD=0.58)

Results

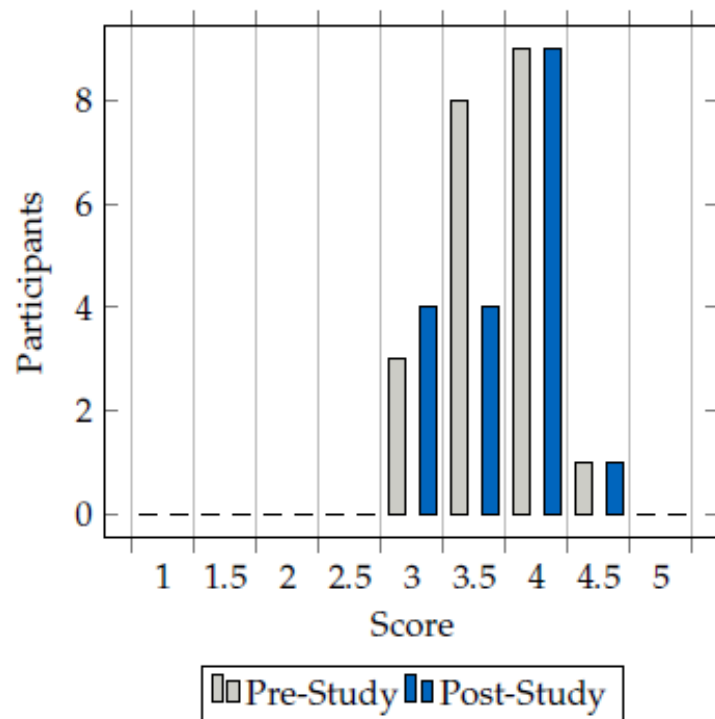
Health Consciousness (Pre-/Post-Study)



- Pre: (M=3.59, SD=0.46)
- Post: (M=3.42, SD=0.49)

Results

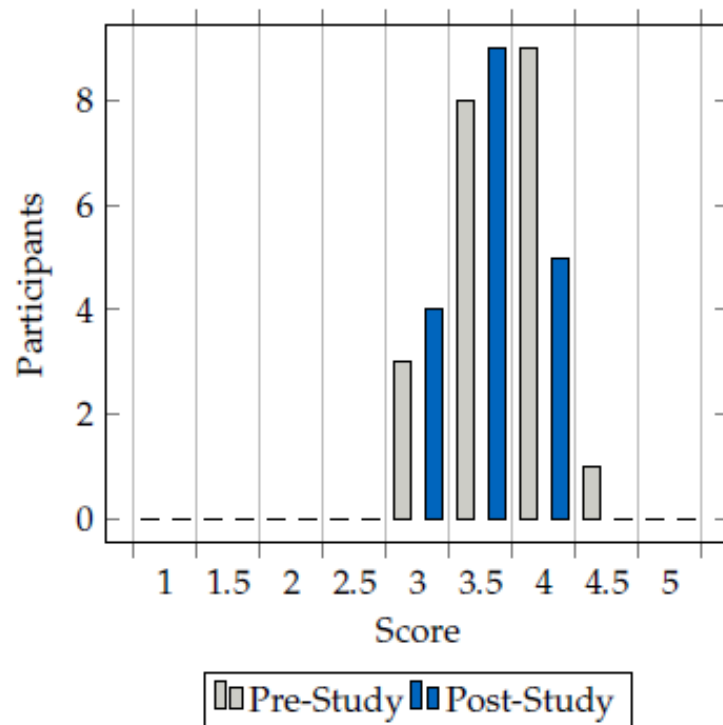
Reflective Thinking (Pre-/Post-Study, Base Questions)



- Pre: (M=3.690, SD=0.40)
- Post: (M=3.694, SD=0.46)

Results

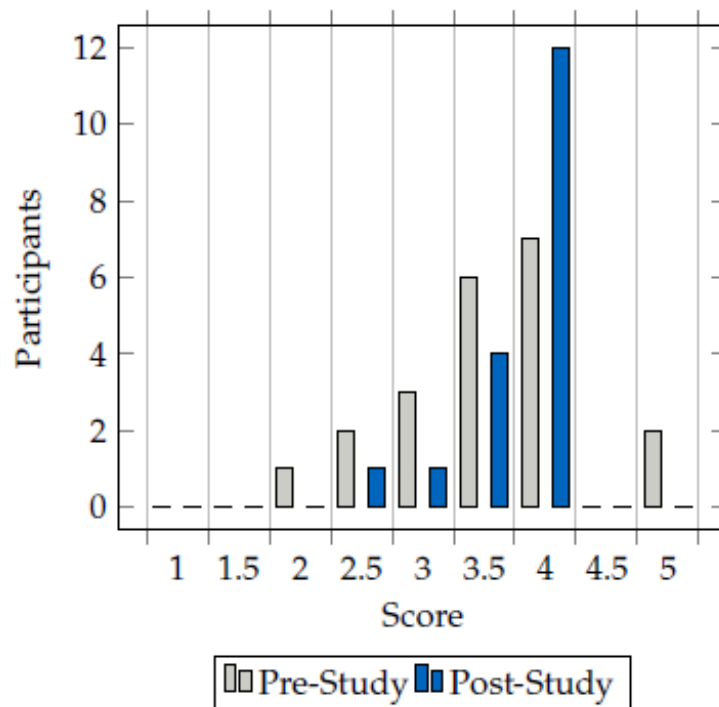
Reflective Thinking (Pre-Study Base Questions, Post-Study Combined Questions)



- Pre (base): (M=3.69, SD=0.40)
- Post (combined): (M=3.53, SD=0.46)

Results

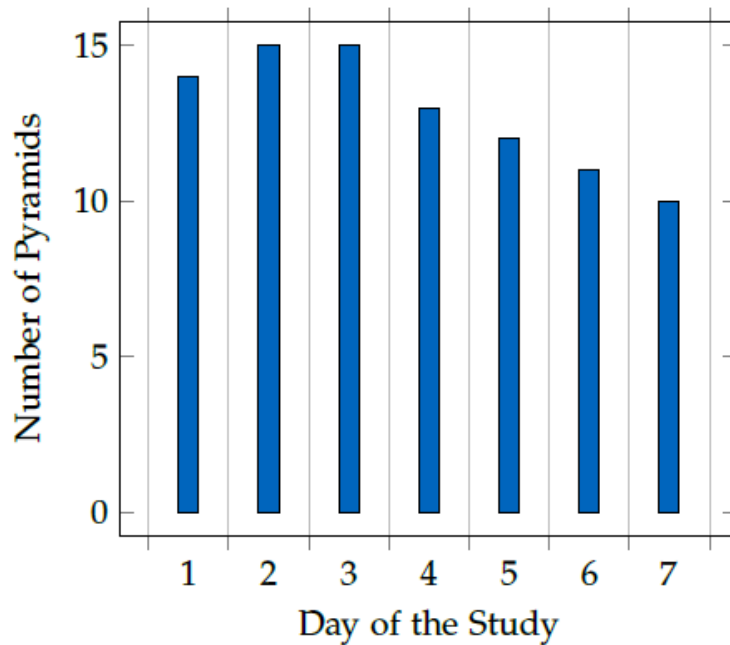
Nutrition Self-Efficacy (Pre-/Post-Study)



- Pre: (M=3.57, SD=0.75)
- Post: (M=3.75, SD=0.43)

Results

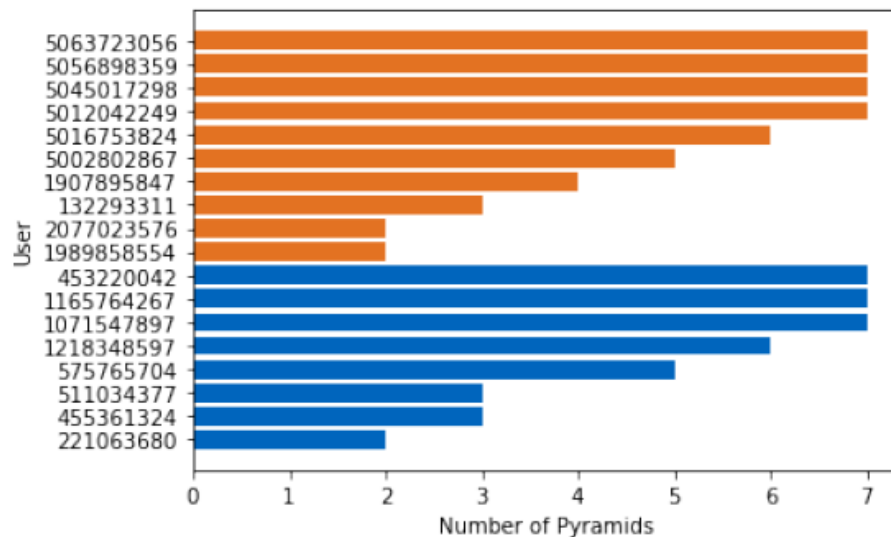
User Data – User Engagement



- Sum of all users: 18
- Max users: 15
- Min users: 10

Results

User Data – Number of Pyramids per User



- Orange: without check-in messages
- Blue: with check-in messages
- Average for both: 5.0 pyramids/user