

Digital microlearning for training and competency development of elderly care personnel: a mixed-methods implementation study to assess needs, effectiveness, and areas of application

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Research Article

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Abstract

Background: Elderly care organisations face challenges today due to high personnel turnover and pandemic-related obstacles in conducting training and competence development programs in a time-sensitive and fit-for-purpose manner. Digital microlearning is a method that attempts to meet these challenges by more quickly adapting to the educational needs of organisations and individual employees in terms of time, place, urgency, and retention capacity, than more traditional competency development methods.

Methods: This study assessed the use of a digital microlearning application which was at the testing stage in the design thinking model among managerial (N=4) and operational (N=22) employees within three elderly care organisations. The app was used to conduct pre-determined competency development courses for the staff. Baseline measurements included participants' previous training and competency development methods and participation, as well as perceived needs in terms of time, design, and channel. They then were introduced to and used a digital microlearning application to conduct two courses on one or more digital devices, schedules, and locations of their own choice during a period ~1 month. The digital application and course content, perceived knowledge retention and work performance and satisfaction were individually assessed via survey upon completion. The survey was complemented with four semi-structured focus group interviews which allowed participants (in total 16 individuals; 6 managerial-administrative employees and 10 operational employees) to describe their experiences with the application and its potential usefulness within their organisations.

Results: The proposed advantages of the digital microlearning application were largely confirmed by the participants' perceptions, particularly regarding ease of use and accessibility, and efficiency and timeliness of knowledge delivery. Assessments were more positive among younger or less experienced employees with more diverse backgrounds. Participants expressed a positive inclination towards using the application, and suggestions provided regarding its potential development and broader use suggested a positive view of digitalization in general.

Conclusions: Our results show that application-based digital microlearning appears to be an appropriate new method for providing such development within the elderly care setting. Its implementation in a larger sample can potentially provide more detailed insights regarding its intended effects.

Background

Adequate training and competence development among personnel in elderly care organisations are not only vital for their own health, well-being, safety, and self-confidence, but also for the outcomes of care receivers. Such development minimizes ill health and related leave-of-absences and enhances staff continuity [1]. Elderly care in Sweden is faced with several concurrent challenges to this kind of training and development. These include high staff turnover, staff with shorter education, inadequate skills, and limited Swedish language proficiency. For this group, standard training and competence development

programs are less prioritized due to heavy workload, more difficult to conduct, and when conducted are less likely to give expected benefits [2].

Regulations regarding infectious disease control as a response to the Covid-19 pandemic also created a dramatic change in work methods, affecting both skills and competency requirements. Fit-for-purpose training and development initiatives needed to be provided in a safe and effective manner despite changes in work routines and limitations on physical gathering and contact. The pandemic also complicated the “feedback loop” between employees and management regarding knowledge and competency gaps, making them more difficult to identify or remedy in time and scope. These developments made many work environments less adaptable in considering the personnel’s health, safety, and development, and led to adverse work-related outcomes and increased absence due to illness [3].

Digital training and competency development tools have the potential to ameliorate some of these challenges. One such tool, digital microlearning, is a less formal competency development tool that aims to fill knowledge gaps identified by the staff themselves through self-assessment, known as personalized learning. To achieve this, digital microlearning provides brief learning modules (seconds to minutes to conduct) on demand via digital means (e.g., computers, mobile telephones, or tablets), and that are highly specific to the individual’s learning context and environment. The method often includes an assessment that is provided in close proximity to the learning modules in terms of timeframe and delivery channel. The aim of digital microlearning is to increase flexibility in organisations’ competency development compared to standard, more formal methods, which are often delivered broadly through written course literature and lectures with a longer time lag between current needs and delivery. Organisations undergoing change may benefit from shorter, more focused and directed training efforts that can be delivered on short notice to specific roles and individuals [4, 5]. A recent review of microlearning in health professions training concluded that, as a competence development strategy, it contributed to positive effects in actual knowledge retention as well as self-confidence in work performance compared to standard training methods [6]. This may be due to a reduction in the information load associated with the broader scope and time allotment of standard formal training [7]. Furthermore, many digital microlearning tools reduce the administrative burden on managers in documenting and following employees’ learning progress towards set goals.

The use of digital microlearning among health and social care settings and professionals is not well-documented in research literature although applications of some thematic materials relevant for these professions, such as dealing with violent behaviour and mental health issues, have been [6].

This current study focused on health and social care organisations providing home and institutional care to elderly persons, to answer following research questions:

1. What are the competency development needs of employees and managers in elderly care organisations in terms of subject matter, time, method of provision and channel(s)?

2. Can digital microlearning meet the identified needs in 1), and if so, how can efficiency of delivery and effectiveness of retention and application be improved?
3. Are professionals' own assessments of confidence in their knowledge and work performance affected by digital microlearning, and if so, how?

To answer research questions 2 and 3, the study employed a digital microlearning application (The Minnity Learning Platform, Minnity AB, Stockholm) that was in the later iterative stages of test mode according to the design thinking model [8]. This study evaluated the effects of a digital microlearning application at the testing stage (stage 4) in the design thinking model (Fig. 1). Stages 1–3 in the model had already been conducted in other populations, although some steps in these stages were repeated in the current study. A co-development process for the application was employed involving the developer, municipal caregiving organisations, and the academic research sector.

Methods

Recruitment and participants

Recruitment of participants to the study was conducted between January and May 2021.

Targeted offers to participate in the study were sent to six health and social care organisations providing home- and institution-based elderly care. The offers specified that a new digital small reimbursement (~950 EUR) would be given for their time. Three organisations volunteered to participate in the study, each located in different Swedish municipalities with comparatively diverse demographic characteristics. Managerial/administrative employees (N = 4) and operational caregiving employees (N = 22) without previous experience of microlearning methods were internally recruited within the organisations to voluntarily participate in the study (N = 26 in total). Participants then received both verbal and written information about the aims of the study, their expected contributions, potential benefits and risks, and how data and personal information gathered during the study would be used in line recommendations on good research practice from Swedish Research Council [9] and the EU General Data Protection Regulation. All participating organisations and employees then provided informed consent verbally and in writing to participate in the study. Background data regarding the organisations and the employee participants were collected from the respective organisations' official administrative data.

Characteristics of the studied organisations

The three participating organisations and the recruited participants from these organisations are described in Table 1.

Table 1
 Characteristics of the participating organisations and employees

	Location	Turnover (2020); number of employees	Total number of care receivers	Study participants
Organisation 1: unit within municipal caregiving company	small municipality (< 30 000 inhabitants)	~37 million EUR; 20–25 employees	50–75; plus several hundred home emergency alarm users	Nine nursing assistants and one manager; average age 49 years (between 35–60 years); average employment experience 13 years (between 0–35 years).
Organisation 2: unit within caregiving foundation	large municipality (~1 000 000 inhabitants)	~6 million EUR; 60–65 permanent contract employees	65–70	Four nursing assistants, two operational team managers and two administrative managers; average age 51 years (between 35–65 years); average employment experience 6 years (between 0–15).
Organisation 3: municipal caregiving unit	small municipality (< 35 000 inhabitants)	2.3 million EUR; 30–35 permanent contract employees	30–35	Six nursing assistants, one operational team manager and one administrative manager; average age 48 years (35–65 years); average employment experience 13 years (0–25).

Intervention

The study intervention was conducted between April and November 2021. It consisted of three stages: 1) Characterisation and assessment of previous competence development and identification of current/future needs, 2) implementation and evaluation of a market-ready digital microlearning application and courses, and 3) assessment of the application’s potential usefulness in meeting future competence development needs.

Characterization and assessment of previous competence development and identification of current/future needs

An online survey of all participants was then conducted to obtain individual responses regarding competence development initiatives conducted during the previous two years of employment, including themes or subject matter, time allotted to, channels and evaluation methods used in, and experiences and satisfaction with such initiatives. For the experiences and satisfaction dimensions, the survey posed statements that the respondent should then choose an appropriate response to from a 5-point Likert scale, with the response alternatives “completely agree”, “mostly agree”, “both agree and disagree”, “mostly disagree” and “completely disagree” (see Appendix 1). The survey also addressed desired

support, needs, and pandemic-related aspects regarding current and future competence development. All participants were given approximately one month to complete the survey.

Implementation and evaluation of the digital microlearning application and courses

Participants were then introduced to The Minnity Learning Platform digital microlearning application that was to be implemented as part of the study. The internet-based application could be used on mobile (smart telephone, tablet) or computer platforms.

All participants received 30 minutes of instructive group training on how to use the application, as well as unlimited access to online manuals and support afterwards. Managers received additional training on how to monitor employee progress through the microlearning modules via the administrative view in the application.

Two full microlearning courses were conducted via the application: 1) Covid-19 and hygiene when providing home care, and 2) care approaches for people with dementia. (A trial of the Covid-19 module is available publicly at <https://learning.minnity.com/login/learn> in English, French and Swedish languages.) The courses consisted of several small modules, each of which was expected to take 2–3 minutes to complete, with a repeatable self-assessment test to be completed at the end of each module (Fig. 2). The entire course therefore was expected to take approximately 15–20 minutes to complete but could be started and stopped after each module, and modules could be repeated as desired. Participants were given 1 month to complete the modules, during which time they could freely choose to conduct the modules as they wished. Individuals' progress through the modules could be seen by themselves as well as the manager involved in the project from their organisation.

Upon completing the course, individuals were then directed to a short (approximately 3-minute) online survey conducted via link from the application, to evaluate their perceptions about the course content, its usefulness and applicability, and different user experience dimensions regarding the digital microlearning application itself (Appendix 2). The surveys posed the same statements and used the same 5-point Likert scale as in the initial survey (1. characterization of previous competence development and identification of current/future needs).

Assessment of the application's potential in meeting future competence development needs

After all participants in an organisation had completed the modules, two semi-structured group interviews were conducted with the managerial-administrative participants and the operational participants, respectively. The approximately 1-hour interviews were conducted either physically or via online meeting as chosen by the participant organisation (which had different restrictions on receiving external visitors during the Covid-19 pandemic), recorded and transcribed. The interviews initially focused on three main themes: 1) the participants' conduct of the digital microlearning courses, such as time, place, amount, and strategy, and their discussions with colleagues regarding the courses' content; 2) their own assessment of the application's and courses contents' effects on their comprehension and retention of

the courses' content, as well as their confidence in and ability to apply the content material in their daily work; and 3) their own assessment of if and how the application could be used in the future within their organisations, how the current course content could be developed, and what other courses that would be useful to conduct. The interviewers assisted participants in identifying sub-themes and additional themes during the interviews using the constant-comparison method [10]. Participants spoke freely both individually and amongst themselves during the interview.

Analyses

For quantitative data, descriptive univariate analysis was applied across organisations and results presented as sums or averages (with range or standard deviation where applicable). Within-groups and between-groups analyses were conducted for the organisation (3 participating) and role within the organisation (2 participating) variables.

Transcribed qualitative interview data was descriptively coded by two researchers (first level) to formulate a primary list of themes and associated citations, followed by second-level coding to expand or amalgamate themes. The themes and their content were summarized and designated as facilitating, hindering or neutral by two researchers independently conducting the analysis.

Results

Organisations 2 and 3 (N = 16) completed all three stages of the study. Organisation 1 (N = 10) completed the first two stages of the study, but not the third stage due to logistical difficulties (both directly and indirectly influenced by the ongoing pandemic) in participating in the interview.

Characterisation and assessment of previous competence development and identification of current/future needs (N = 26)

For all organisations, 50% of employees confirmed that they had participated in educational or competence development initiatives within the organisation during the two years prior to the study. Of those confirming, 50% had participated for 1–2 days per year, 14% for 3–5 days per year, 7% for 6–10 days, 22% for 11–20 days per year, and 7% for more than 20 days per year. There was no difference between organisations for these measures, although managerial and administrative employees on average (+/- SD) participated in more initiatives (12.5 +/- 9.6 days) than operational employees (1.6 +/- 4.2 days). Web-based educational modules consisting of mixed educational methods (video and text lectures, quizzes, and assignments) were the most common form of competence development participated in (40%) while lectures (online or in person) were the next most popular (30%). Workshops (10%), internships or mentoring (6.6%), and structured reading, study circles, written assignments, or other methods (3.3% each) were also used. For conducting educational and competence development initiatives, the workplace was the most common site (65.2%), while educational institutions (8.7%), own

residence or other site (13.0% each) were less used. Educators outside of the organisation were most used (35.7%) when conducting the educational initiatives, followed by web-based content (25.0%), internal educators (21.4%), paper literature (14.3%) and other resources (3.5%).

The individual assessments of previously conducted education or competence development initiatives are shown in Fig. 3.

Evaluation of the digital microlearning courses and application (N = 26)

The survey assessments of the digital microlearning courses showed that a majority of participants were entirely or mostly in agreement regarding the content in both the Covid-19 and dementia courses. Participants found these useful and beneficial, they were likely to retain the knowledge gained from them, could apply the knowledge gained in their work, it would improve their work performance, work environment and workflows, and that they enjoyed attending the course (Fig. 4a and b). However, the majority mostly disagreed or disagreed regarding satisfaction with work following attending the Covid-19 module, and new knowledge gained from the dementia module. No differences were found between operational and managerial-administrative participants' responses regarding the courses.

A majority of the participants were also entirely or mostly in agreement that the digital microlearning application was simple to use and well-integrated, and that they could quickly learn to use it, felt comfortable in using it, and wanted to use it regularly (Fig. 5). There were no differences between the operational and managerial-administrative participants' responses regarding the application.

Assessment of the digital microlearning application's potential in meeting future competence development needs (N = 16)

Several future course topics were suggested as appropriate for the digital microlearning application in comparison to traditional, planned educational initiatives, due to its more time-sensitive, on-demand nature, including:

- Protective- and restrictive interventions for aggressive or violent care receivers, as well as management and prevention of other behavioural problems such as problematic anxiety and restlessness. These were seen as more acute in time and that expedient access to knowledge would be particularly useful delivered through the application.
- Mealtime layout planning, and related cultural knowledge at holiday meal settings. These events were often time-specific and in some cases needed adjustment on a very short time scale, and the knowledge level of employees with non-Swedish ethnic and geographic background on this topic required additional support.

- Digital signing and transfer of responsibilities regarding e.g., care provision or medication, as well as documentation of e.g., adverse events or deviating procedures. These have strict local, regional- and/or national regulations that newer employees felt a need for support in adhering to.
- Purely methods-related knowledge, such as wound and sore management, how to apply insulin or eyedrops in various care receiving groups.
- Areas of knowledge that changed quickly due to e.g., regulation development, societal or organisational changes, or research-based findings. The changing knowledge status during the Covid-19 pandemic was according to some a particularly relevant example of how needs could be more easily solved in a digital microlearning setting.

A key advantage in having these topics provided via digital microlearning application was that several employees felt that knowledge retention would be greater with the ability to repeat the same educational modules. Previously offered educational initiatives were often single sessions and significant amounts of the material were quickly forgotten according to some. For example, one nurse summarized: *“(The course material) is fresh in your mind while you’re there, but the forgetfulness sets in fast”*. Another stated that with the application, *“...you can have the material close to you all the time... and use it to quickly freshen up your memory”*.

Other potential topics were seen as appropriate for the digital microlearning application, but in tandem or complementary to previously used, planned educational initiatives as they could not provide the in-depth material, discussion of it with colleagues and instructors, or collegial guidance that the previously used methods enabled. As one nursing assistant stated, *“Some education needs to be about ethics and dilemmas... and then it’s better to be in the same place with others and have a forum for discussion.”*

Examples of such topics included:

- Support to relatives and informal caretakers when the professional caretakers were not available or involved, regarding e.g., the management or transfer of certain care responsibilities requiring a higher level of knowledge or proficiency. The application was seen as useful in providing a similarly accessible and summary format to informal caregivers *“on the spot”*.
- End-of-life and palliative care routines, where certain recurring situations or events required expedient access to standard knowledge. The ethical and personal reflection regarding such situations was however not seen as appropriate for the application and required other educational approaches.

Other user groups’ interaction with the digital microlearning application

Study participants also commented that the application would be useful for other user groups that had a stake in their own work activities, specifically managers within the organisation, informal caregivers or relatives, and other relevant professional groups such as doctors and nurses within primary or secondary care, physio- and work therapists.

Managerial participants had access to a function that allowed them to see operational participants' time and level of completion of the modules, and this function was considered useful so that reminders could be provided. This function was employed during the study to remind operational participants who had not completed the courses that they were nearing the end of the designated period for that within the study.

For informal caregivers and relatives, a similar supportive function in obtaining new knowledge as for professional caregivers was seen as potentially useful by the study participants. This would potentially allow less confusion and a higher level of informal care when both professional and non-professional caretakers were helping the same individuals. It was suggested that the course content would be adjusted to the user group, but that similar themes or topics of relevance to the organisation would be available on the informal caregivers' own devices, and that new content could be delivered as seen fit.

For other professional caregiving groups such as doctors, nurses, and therapists, it was seen by several study participants as beneficial that these groups "*could see the same material*" as the study participants, primarily to reduce confusion when transferring care duties, as these groups were often seen as having a lower level of knowledge regarding elderly care in their own professions. Through use of the application, these groups could gain and adhere to the same knowledge base. Some study participants expected that these other professions could for various reasons not prioritize the same educational initiatives as the elderly care professionals, and thus, the digital microlearning application was more likely to be used due to its added advantage regarding time- and availability.

Some disadvantages were also noted in using the digital microlearning application regarding meeting future competence development needs. These included some local routines that did not allow the use of personal mobile devices while interacting with care receivers, and the inability to install on, or overall inaccessibility of organisation-provided mobile devices or internet connection. Hygiene aspects related to digital device were also raised as a concern; "*yet another time I need to think about washing my hands*" was one response when deciding whether to take up their mobile to do part of a course. This was seen as general digitalization challenges that some organisations had not yet overcome. One team manager stated regarding this issue:

We say all the time that (the mobile phones) they should not be in our pockets when we're on the floor, but in our bags instead... but at the same time we need to be more digital. We give very mixed signals to our employees about this.

For those organisations that had come further in their digitalization, the application's lack of integration with existing digital administrative platforms, or within existing workflows, was also seen by some as an inconvenience to using it. "Not another self-standing application" with its own login requirements, device of installation etc. was a comment fielded by a few employees. Some employees with a lower level of Swedish language competency, with dyslexia or other learning difficulties also felt that the textual content itself was "too academic" or advanced, and thus difficult to understand.

Some employees were slightly dismayed at the inability to use the application as a type of knowledge base that could be utilized more like a guidebook or encyclopaedia, for already attained knowledge or to replace existing local knowledge documentation currently in paper form. While the application was not presented as such a solution, some employees felt that it would have been at least as useful in this role as in providing new knowledge content.

The ability to both read and listen to the content was seen as a potential development of the application, which currently only provided content visually (via text, images, and video). Other audio content such as podcasts within the application were also suggested as complementary material to the course content. Varying the course content for different professional roles using it was also seen as a potentially useful development.

Discussion

The challenges within elderly care in Sweden today, including high staff turnover, staff with limited education or skills, limited workload flexibility, and limited Swedish language proficiency [8], create challenges for organisational planning of educational and competency development initiatives. The observed reduction in expected benefits from standard training and competency development programs [2], along with the dramatic change in work methods and routines experienced during the pandemic, has elucidated the necessity of providing continuing educational development in new and more effective ways [11]. Our results show that application-based digital microlearning appears to be an appropriate new method for providing such development within the elderly care setting. The proposed advantages of the digital microlearning application were largely confirmed by the participants' perceptions, particularly regarding ease of use and accessibility, and efficiency and timeliness of knowledge delivery. Our results are in line with a recent systematic review (6) of 17 studies that demonstrated a positive effect of microlearning on the knowledge and confidence of health professions students in performing procedures, retaining knowledge, studying, and engaging in collaborative learning.

While some knowledge areas were deemed appropriate for delivery through the application, others requiring more discussion or reflection were viewed as less appropriate. In these cases, the microlearning method was thought to be more appropriate as a complement or addition to previously used competence development methods. This suggests a combined, tailored approach to course theme and content is advisable when using digital microlearning for complex themes, and that stand-alone courses conducted via such an application should be appropriately limited in terms of scope, interpretability and/or dimensional complexity.

That a majority of the participants partially or entirely disagreed that new knowledge had been attained following the dementia course may be explained by the initial knowledge level of the participating organisations. The employees of one participating organisation appear to have accounted for most of the disagreement, and the remainder from other organisations' employees that had among the longest operational careers within elderly care. Since the themes for the two courses conducted within the study

were pre-determined without direct input from the participating organisations, the material may have been perceived as repetitive or less necessary in relation to current knowledge needs. Similarly, the majority that disagreed that workplace satisfaction had increased following the Covid-19 course were also characterized by longer employment histories. This might suggest that the microlearning courses used in the study provided greater benefits for younger or newer employees in organisations that had more apparent knowledge needs within the course themes. Microlearning courses are, outside of the current study, designed and provided in accordance with user organisations' needs and wishes, which would likely lead to more positive ratings of the application's perceived usefulness. Our results therefore advise carefully considering organisation-specific aspects and context both when implementing and assessing effects of digital microlearning in health and social care organisations.

Participants perceived an increase in confidence in knowledge and work performance benefits following their use of the application. Ideally, the use of a digital microlearning would then lead to better health outcomes and improved safety and quality of life for care receivers. This would in create both organisational improvements sooner and increase the return on investment for competency development initiatives. Although our current study did not measure such health, safety, and quality of life outcomes among care receivers, the obtained results suggest that such outcomes could logically be achieved. Further research that measures such outcomes would be justified in future studies of digital microlearning.

The application development suggestions from the study participants, including audio-based functions, searchable reference-type functions, and adaptable text content for user groups, suggests an interest in utilizing the capabilities of digital platforms even more than currently. Combined with the overall positive assessment of the application this can be interpreted as a willingness to digitalize, including the more traditional aspects of health and social care workplaces such as education and training. These results also support upscaled testing within the co-development process for the digital microlearning application.

Considering the challenges regarding staff composition and recruitment within the elderly care sector, research regarding competency development via digital methods might help identify ways of increasing the attractiveness of the caregiving professions. The assessed digital microlearning application demonstrated good potential to assist organisational transformation through tailored employee development with little perceived resistance. The benefits of this may be more pronounced among younger or less experienced employees with more diverse backgrounds, which would fit well with currently dominating demographic trends in health and social care personnel management.

Conclusions

This study contributes to the currently limited empirical evidence related to digital microlearning [12]. The digital microlearning application demonstrated positive effects at the testing stage in the design thinking model and appears mature for implementation in wider, but more tailored use. Competence development strategies should consider digital microlearning as a potential intervention in health and social care

organisations. Future research should focus on evaluation of health-related outcomes, quality of care and/or employee health outcomes following digital microlearning interventions.

Abbreviations

HWT: Health and Welfare Technology

EUR: Euros (currency)

Declarations

Ethics approval and consent to participate

All participants received both verbal and written information about the aims of the study, their expected contributions, potential benefits and risks, and how data and personal information gathered during the study would be used in line recommendations on good research practice from Swedish Research Council [9] and the EU General Data Protection Regulation. Thereafter, participants provided informed consent verbally and in writing to voluntarily participate in the study.

As individuals were participating within and during their roles as employees, the individual participants' employer organisations also provided informed consent verbally and in writing. The need for ethical committee approval was waived by Mälardalen University in consultation with the guidelines provided by the Swedish Ethics Review Authority (*Etikprövningsmyndigheten*). All protocols were approved by the School of Health and Welfare at Mälardalen University and in accordance with university guidelines and regulations.

Consent for publication

Not applicable.

Availability of data and materials

The anonymised datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

MXR, OA and SWA declare they have no financial or otherwise competing interests in the study. KHW is the CEO and co-founder of Minnity AB, the developer of the digital microlearning application used in the intervention.

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Authors' contributions

All authors contributed to the study idea and methodology. MXR and OA conducted the data collection and the data analyses. KHW provided the digital microlearning application and support for users during the data collection. MXR, OA and SWA authored the manuscript, and all authors have read it upon submission.

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Figures

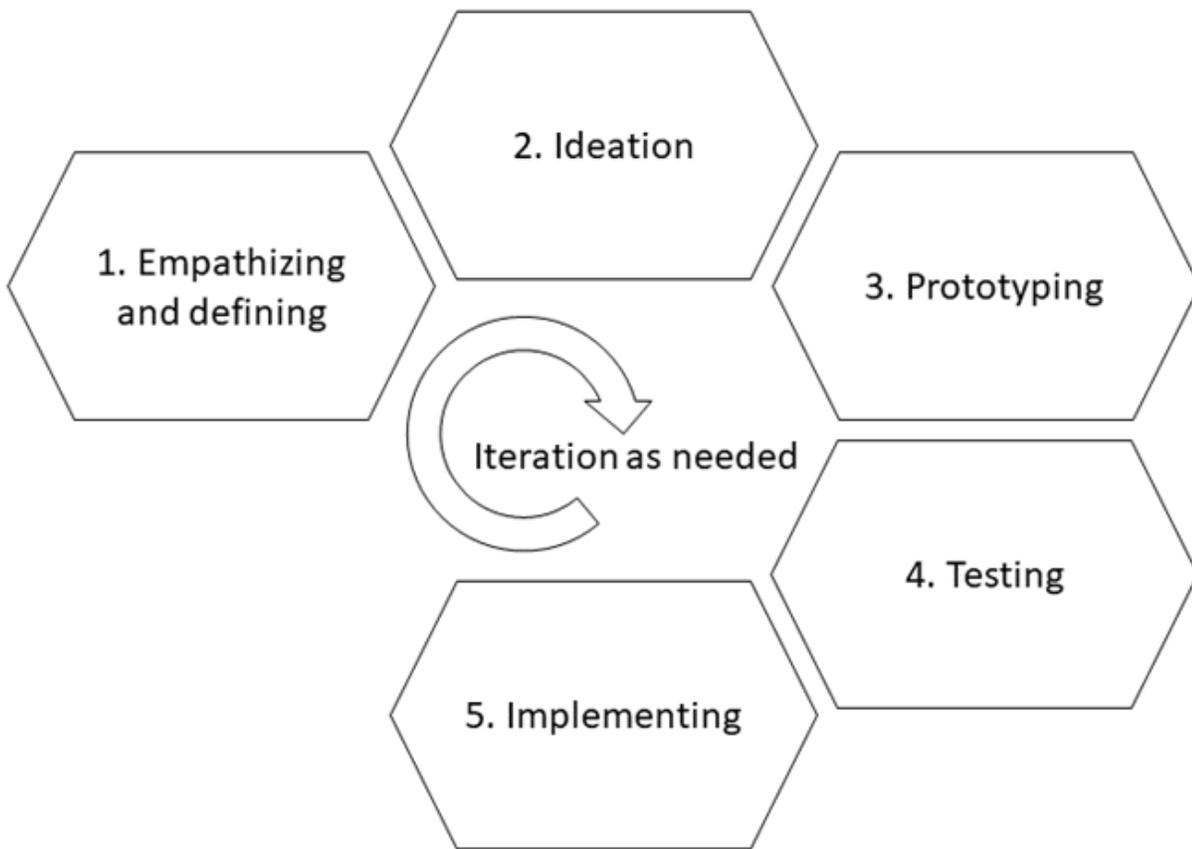


Figure 1

The stages of the Design Thinking Model [8]. The digital microlearning application in this study was in Stage 4 at the time of the study and had undergone previous iterative rounds of the other stages.

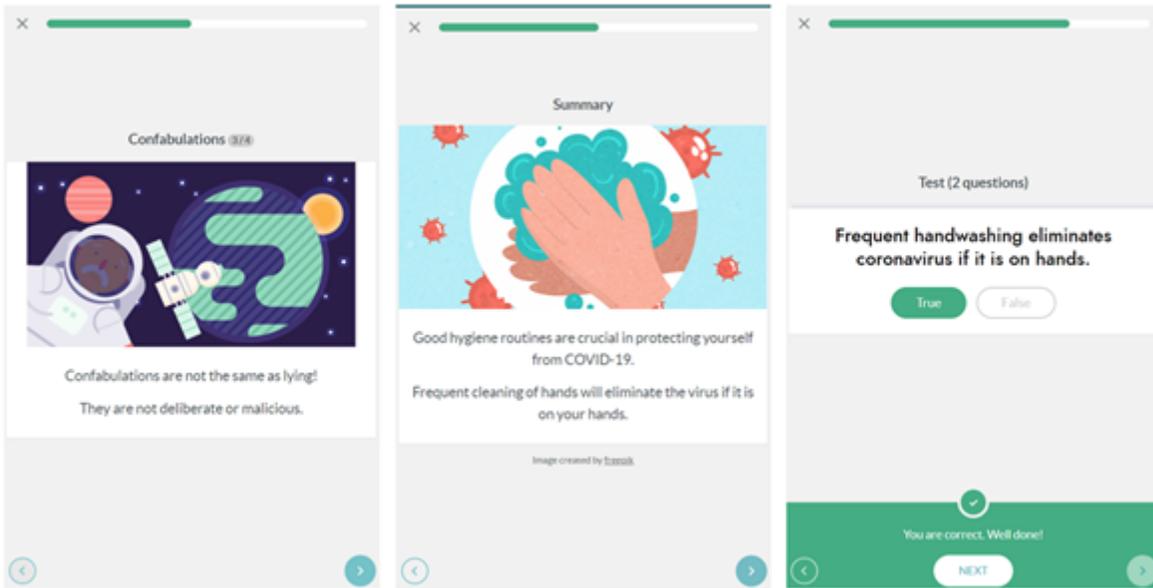


Figure 2

Screen shots from the mobile version of the digital microlearning application. From left to right: from the dementia course, from the hygiene course, and from the self-assessment test for the hygiene course.

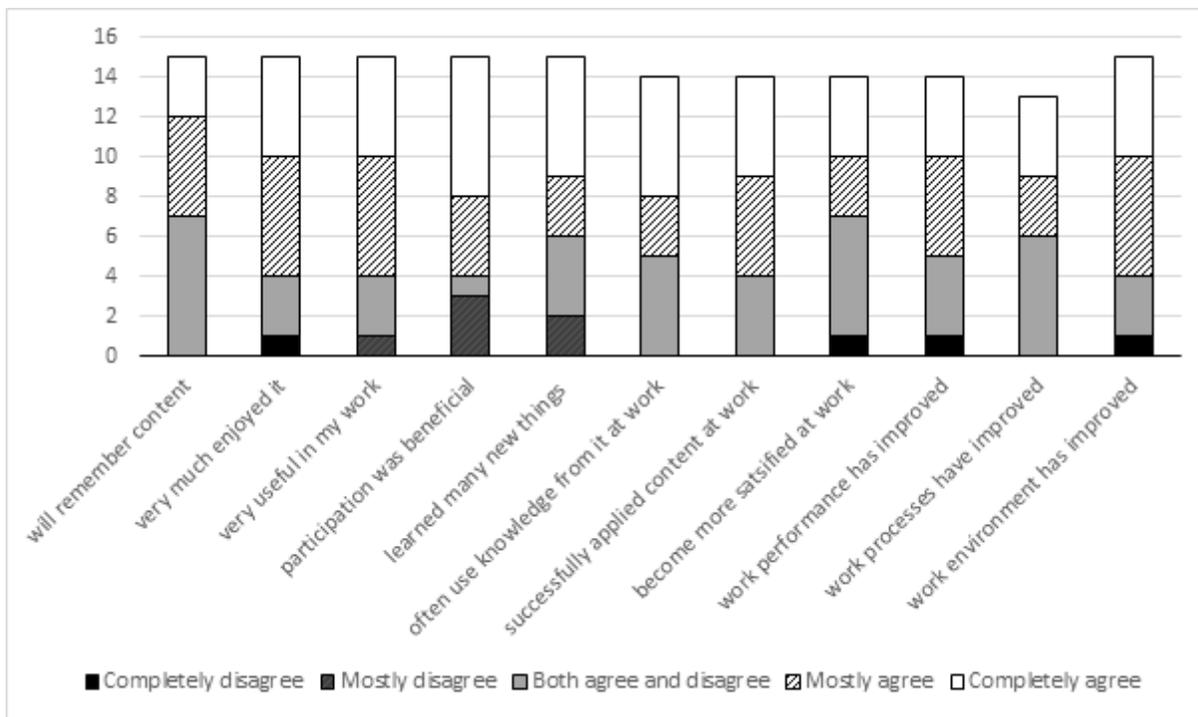


Figure 3

Participants' (N=26) assessment of previous competency development and educational initiatives conducted within their respective organisations. The statements under the bars that participants stated

their level of agreement about are shortened for space purposes; the full statements can be found in Appendix 1.

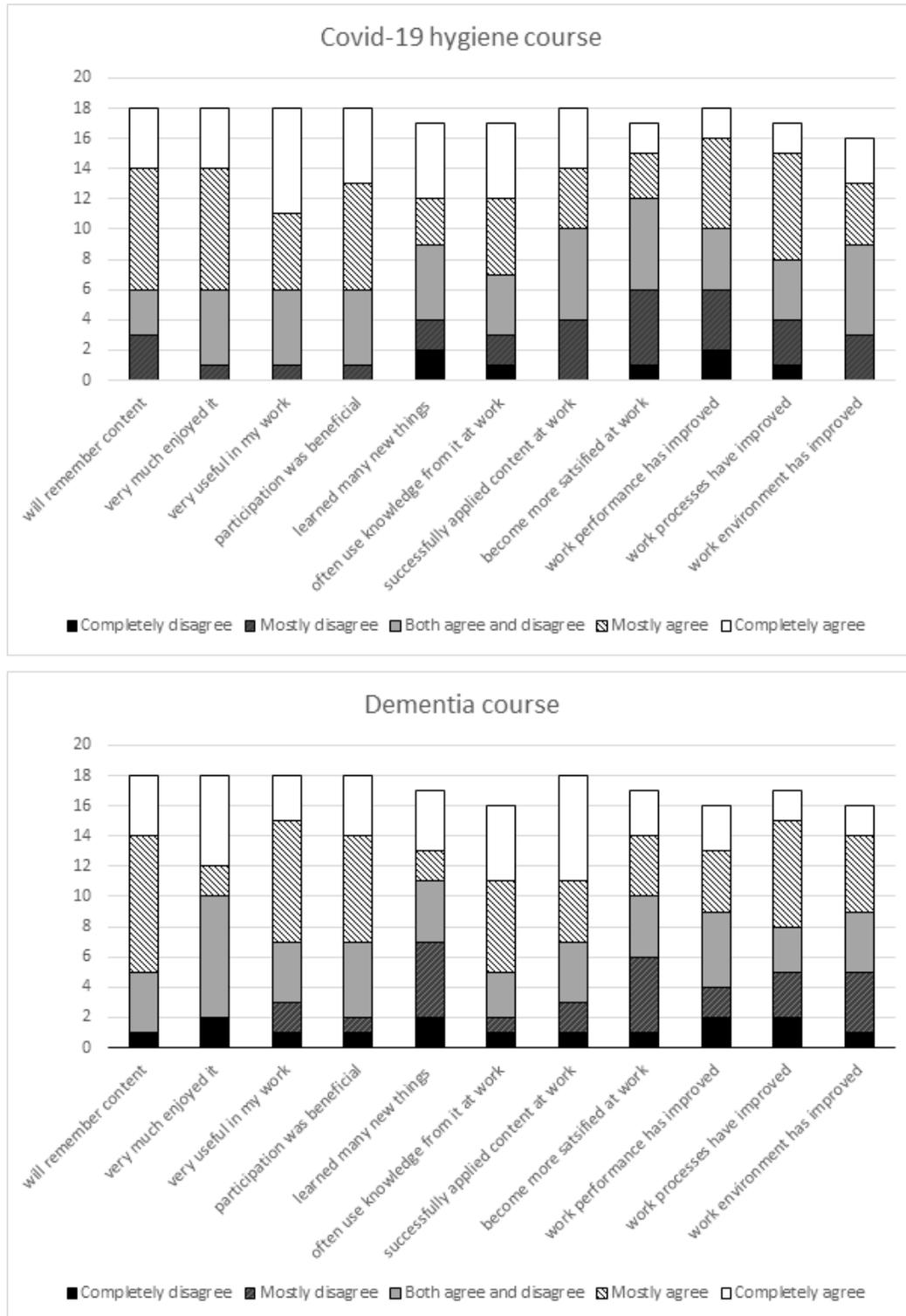


Figure 4

4a and b. Participants' (N=26) assessment of the two digital microlearning courses. The statements under the bars that participants stated their level of agreement about are shortened for space purposes; the full statements can be found in Appendix 1.

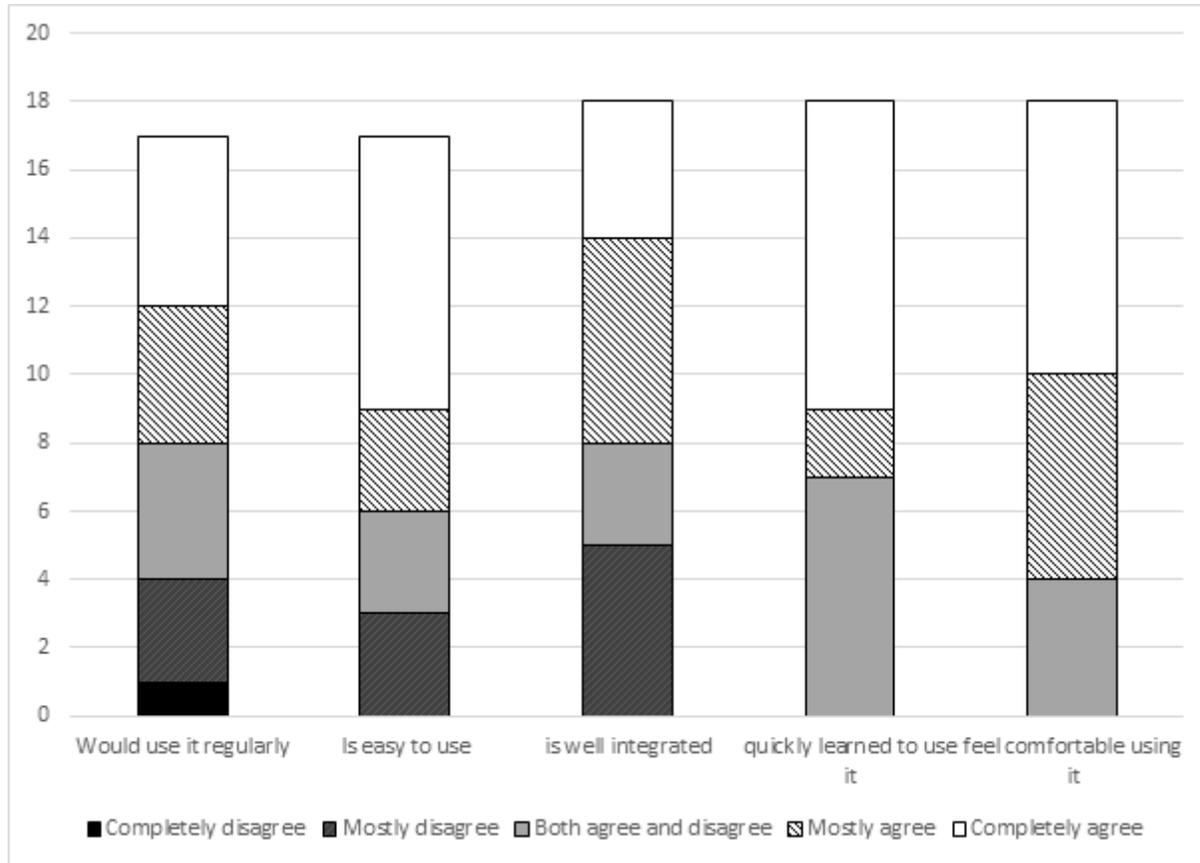


Figure 5

Participants' (N=16) assessment of the digital microlearning application. The statements under the bars that participants stated their level of agreement about are shortened for space purposes; the full statements can be found in Appendix 1.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Appendix1.docx](#)