*Training, Education, and Learning Sciences,* Vol. 59, 2022, 285–294
https://doi.org/10.54941/ahfe1002412

# Motivational Design of an E-Learning Application for Managers in Healthcare

**Marisa Schirmer[1], Mareike Sorge[2], Christina Mayer[1], Wiebke Stöver[1], Verena Nitsch[1], and Susanne Mütze-Niewöhner[1]**

[1]Institute of Industrial Engineering and Ergonomics (IAW), RWTH Aachen University, Germany
[2]Fraunhofer Institute for Factory Operation and Automation (IFF), Magdeburg, Germany

## ABSTRACT

The working life of managers in healthcare is characterized by time pressure und diverse requirements from different stakeholders. E-learning applications may support managers in acquiring the required knowledge at any time. Since the motivation to use e-learning opportunities remains rather low if time resources are tight, this study investigates which didactical design aspects contribute to healthcare managers using a digital learning application. In a survey with 36 healthcare managers, recommendations for a motivational design based on the ARCS model are evaluated. This paper describes the findings and the resulting suggestions for the design of the e-learning application in healthcare. The results show that some recommendations are appropriate for the context. For example, the e-learning application should have an avatar with identification potential and a personalized language, as well as a feedback system that uses both icons and text.

**Keywords:** E-Learning application, Motivational design, Healthcare

## INTRODUCTION

Managers in healthcare work are confronted on a daily basis by the requirements of their employees, of patients and other stakeholders. At the same time, they are permanently under great time pressure (Vincent-Höper et al. 2020). In addition, the fast pace of today's world means that required knowledge must be constantly revised or relearned, and managers are repeatedly faced with new problems (Daniel and Wolbrink 2019). The use of e-learning applications instead of traditional continuing education is one way to overcome such barriers (Reeves et al. 2017). However, if time resources are very tight, the motivation to use e-learning opportunities remains rather low.

The motivation and thus the personal attitude of the learner can be affected by didactical design aspects (Zander and Heidig 2019). Therefore, many contributions and models on motivational design and the design of virtual learning environments are available in the literature. One of these models is the ARCS model, which was first introduced by Keller in 1984.

The model gives specific instructions for the design of the four areas of human motivation to learn, namely *Attention*, *Relevance*, *Confidence* and *Satisfaction* (Keller 2010).

For the following reasons, the ARCS model was selected as starting point for the motivational design of an e-learning application for managers in healthcare: First, this model includes a systematic approach and enables a generic basis for the development of motivational strategies in different e-learning contexts (Chang and Chen 2015). Second, other motivational design models tend to focus on the cognitive aspects of learning rather than on the affective, leaving motivation (Shellnut et al. 1999). Considering only the cognitive aspects is not sufficient for designing e-learning applications; rather, a holistic view is needed (Zaharias 2005). Third, many of the findings and recommendations in the literature on increasing learner motivation can be assigned to the four categories of the model (Hodges 2004). Thus, the ARCS model represents a holistic approach that supports a complete view on the target group and contributes to the selection of design options that match the needs for their motivation (Keller and Suzuki 2004). Fourth, the model has already been validated empirically several times, mainly in quantitative studies, as well as tested in different contexts and educational settings (Li and Keller 2018). A more recent version of the ARCS model by Zander and Heidig (2019) bundles design recommendations on aspects of learning motivation from various expert contributions. This version serves as the fundament for the following study.

Since learner attitudes and motivation can be influenced by context, among other factors, design recommendations must be individually reviewed for each context before they are applied (Simsek 2014). As this also holds true for the context of healthcare, this article examines which design recommendations motivate healthcare managers to use an e-learning application.

Especially for the healthcare sector, e-learning applications are convenient due to their flexible usage possibilities. In context of the development of an e-learning application to guide healthcare managers to a situation-appropriate and reflective approach to decision-making processes, the following research question arises:

**Based on the ARCS model, what recommendations for designing a digital learning application can be made to increase the motivation of managers in healthcare for using it?**

## METHOD

Following the ARCS model, design-related recommendations were tested in an online survey to find out whether the proposed designs would motivate managers to use a digital learning application. The participants of the study correspond to the target group of the e-learning application to be developed, in order to ensure that the design is suitable for and accepted by them. The following two subsections describe the development of the questionnaire based on the ARCS model and the study sample.

## Questionnaire Design

Based on previous literature on the ARCS model (Chang and Chen 2015, Keller 2010, Loorbach et al. 2015, Ma and Lee 2021, Zander and Heidig 2019), 30 items were developed to measure the preferred motivational design of an e-learning application within the context of healthcare on a five-point Likert scale (*1 = strongly disagree* to *5 = strongly agree*). Six open questions were added in order to give the participants the opportunity of writing down further comments on the considered topics. There is an *Instructional Materials Motivation Survey (IMMS)* (Keller 2010) to capture the categories of the ARCS model. This was not applicable for the study because the e-learning application is in an early development stage, complete learning materials are not available yet, and rather specific items were needed for certain development steps.

For each of the four categories of the ARCS model, one or two subcategories were chosen to serve as the basis for the design recommendations for the respective areas. The category *Attention* includes recommendations aimed at gaining and maintaining learner attention (Zander and Heidig 2019). Therefore, six items were asked about *the use of audiovisual effects* and five items about *the evocation of learner responses*. The category *Relevance* aims to give design recommendations on making learners aware of the importance of the content (Zander and Heidig 2019). Hence, six items were developed on *the use of a sympathetic character* and three items on *the use of a personalized language*. Recommendations in the category *Confidence* are designed to support learners' confidence in success (Zander and Heidig 2019), so five items were asked about *the explanation of assessment criteria*. Recommendations from the last category *Satisfaction* support to make learners feel satisfied with their own learning progress and thus maintain their efforts (Zander and Heidig 2019). For this, *the creation of a sense of achievement in the form of feedback* is measured by nine items and *the use of transparent, understandable assessment measures* by two further items.

The survey was implemented as an online questionnaire in German. The considered categories were supported with fitting comparative graphics or situation descriptions from the current state of development of the e-learning application. Mean (M), standard deviation (SD), minimum value (Min) and maximum value (Max) were determined for all items. For the interpretation of the results, assuming the central limit theorem, the SD was used to examine the dispersion of the responses around the M value of the individual items (Fahrmeir et al. 2016). In addition, percentages were considered to show how many participants tend to disagree or agree with the items, as well as chose the neutral response option. Furthermore, the following assumptions were made:

- Items with $M < 3$ are not considered for the motivational design of the e-learning application, except inverted items.
- No tendencies can be derived for the items with $3 \leq M < 4$.
- All items with $M \geq 4$ are used for design recommendations for the e-learning application.

**Table 1.** Descriptive statistics of the specific items for the category *Attention* based on the ARCS model.

| Item | M | SD | Min | Max |
|---|---|---|---|---|
| **The use of audiovisual effects** | | | | |
| Audiovisual effects basically motivate me and grab my attention. | 3.50 | 1.12 | 1 | 5 |
| Background music motivates me and grabs my attention. | 2.53 | 1.30 | 1 | 5 |
| Moving graphics motivate me and grab my attention. | 3.42 | 1.19 | 1 | 5 |
| Signal tones that sound when an action is performed or an item is clicked motivate me and grab my attention. | 3.00 | 1.22 | 1 | 5 |
| I prefer a read-aloud function for texts. | 2.28 | 1.26 | 1 | 5 |
| **The evocation of learner responses** | | | | |
| The question-and-answer format for the transfer of the learning content appeals to me. | 4.14 | 0.75 | 2 | 5 |
| The question-and-answer format for the transfer of the learning content increases my attention. | 4.14 | 0.67 | 3 | 5 |
| The question-and-answer format motivates me to find out more about the learning content. | 4.06 | 0.70 | 2 | 5 |
| I prefer the chat format for presenting the question-answer sequence. | 3.56 | 1.14 | 1 | 5 |

## Description of the Sample

The online questionnaire was completed by 36 managers in healthcare. Of the participants, n = 23 indicated the male gender, while n = 12 selected *female* and n = 1 selected *diverse*. The respondents' age ranged from Min = 22 years to Max = 62 years (M = 40.78 years, SD = 9.19 years).

The sample includes participants from different fields in healthcare. The *medical and nursing field* was selected by n = 33 respondents. The other participants chose the *commercial field* (n = 2) or *further explanation* (n = 1).

## RESULTS

The descriptive analysis of the collected items is divided below according to the four categories of the ARCS model and presented in the respective tables. Since the survey was conducted in German, the following items have been translated into English.

The results of the items for the category *Attention* are shown in Table 1. The analysis of the item on audiovisual effects in the form of background music (M = 2.53, SD = 1.30) indicates that the participants tend to rather disagree that this motivates or grabs the attention. 58.33 % of the answers (n = 21) are located in the lower range of the scale and thus, the majority of participants disagrees. The distribution of answers for the use of signal

**Table 2.** Descriptive statistics of the specific items for the category *Relevance* based on the ARCS model.

| Item | M | SD | Min | Max |
|---|---|---|---|---|
| **The use of a sympathetic character** | | | | |
| I prefer an e-learning application in which a virtual, human figure conveys the learning content to me. | 4.03 | 1.01 | 1 | 5 |
| I prefer an e-learning application in which a virtual, non-human figure conveys the learning content to me. | 2.06 | 1.20 | 1 | 5 |
| I find a virtual figure distracting when conveying learning content (inverted item). | 1.94 | 0.97 | 1 | 5 |
| I prefer an e-learning application in which learning content is conveyed to me with pure explanatory texts without a virtual figure. | 2.06 | 1.00 | 1 | 4 |
| I find pure explanatory texts without a virtual figure tiring. | 3.86 | 1.16 | 1 | 5 |
| **The use of personalized language** | | | | |
| Addressing me by my name in the e-learning application motivates me. | 4.11 | 0.99 | 1 | 5 |
| Which form of address do you prefer? *Informally* (n = 29), *Formally* (n = 7) | | | | |

tones (M = 3.00, SD = 1.22) shows n = 15 (41.67 %) responses for *neutral*, as well as a consistent distribution of remaining responses among the other four options. This does not enable a conclusion about design recommendations for the digital learning application in healthcare. The item on moving graphics (M = 3.42, SD = 1.19) has a higher mean value than those on signal tones or background music. Here, n = 20 participants (55.56 %) tend to agree that moving graphics motivate and grab the attention. However, since the mean value lies within $3 \leq M < 4$, it is not possible to derive a design recommendation for this target group due to an unclear tendency.

In order to evaluate *the evocation of learner responses*, the content of a short teaching unit was prepared as a question-and-answer format as well as a pure information text and comparatively juxtaposed. The responses to the corresponding items show that n = 30 or more participants (at least 83.33 %) tend to rather or fully agree. This allows the assumption that the question-and-answer format motivates to find out more about the content (M = 4.06), it is appealing and also increases the attention (both M = 4.14). These three items also show the lowest SD values in this survey (between SD = 0.67 and SD = 0.75), indicating that the participants are most likely agreed on the related statements.

The descriptive analysis of the category *Relevance* is presented in Table 2. The results indicate that the participants prefer a virtual figure rather than pure explanatory texts to convey the learning content. This can be seen, for example, in a rather low preference for an e-learning application with explanatory texts without a virtual figure (M = 2.06, SD = 1.00). For this item, n = 25 respondents (69.44 %) tend to rather or fully disagree, while only

n = 4 of them (11.11 %) rather agree. In addition, 66.67 % of the participants (n = 24) agree that they find pure explanatory texts without a virtual figure tiring (M = 3.86, SD = 1.16). A comparison of the two items on the specification of the virtual figure indicates that the participants prefer a human figure (M = 4.03, SD = 1.01) rather than a non-human figure (M = 2.06, SD = 1.20).

Furthermore, 80.56 % (n = 29) state that they would prefer an informally address in the e-learning application. In addition, the results of the personalized language suggest that addressing the respondents by name is perceived as strongly motivating (M = 4.11, SD = 0.99), with n = 31 responses (86.11 %) agreeing on this item.

Table 3 shows the evaluation of the category *Confidence*.

**Table 3.** Descriptive statistics of the specific items for the category *Confidence* based on the ARCS model.

| Item | M | SD | Min | Max |
|---|---|---|---|---|
| **The explanation of assessment criteria** | | | | |
| An evaluation in the form of icons motivates me. | 3.89 | 1.12 | 1 | 5 |
| The explanation of the icons of the assessment system is relevant for me. | 3.56 | 1.19 | 2 | 5 |
| I would like to get the assessment system explained before starting the game. | 3.86 | 1.13 | 1 | 5 |
| It is enough for me if I get the assessment system explained one by one during the game. | 2.56 | 1.12 | 1 | 4 |

Based on the results, it seems reasonable to assume that the participants would rather get the assessment system explained before the game starts (M = 3.86, SD = 1.13) than during the game (M = 2.56, SD = 1.12). An explanation before the start was agreed by n = 26 participants (72.22 %), while in each case n = 5 (13.89 %) disagreed or were neutral. The analysis of the item on a successive explanation during the game (M = 2.56, SD = 1.12) indicates that the respondents tend to rather disagree. This assumption is supported by the fact that n = 20 participants (55.56 %) disagree that they would like to get a successive explanation, and no one fully agrees (Max = 4).

The item on motivation through an evaluation with icons (M = 3.89, SD = 1.12) shows that 77.78 % of the participants (n = 28) tend to rather or fully agree with the statement. Answers to the open question suggest that the color scheme of the icons can also be relevant.

However, three of the four items on *the explanation of assessment criteria* have a mean value of $3 \leq M < 4$. Therefore, no clear recommendations for the e-learning application can be derived from them.

The descriptive analysis of the items related to *Satisfaction* is shown in Table 4. To evaluate *the creation of a sense of achievement in the form of feedback* for the e-learning application, a detailed feedback including a statement for the rating was compared to a brief feedback without a statement. The results show, for example, that learners experience a higher feeling of being rewarded when a detailed feedback is given (M = 3.94, SD = 1.20)

**Table 4.** Descriptive statistics of the specific items for the category *Satisfaction* based on the ARCS model.

| Item | M | SD | Min | Max |
|---|---|---|---|---|
| **The creation of a sense of achievement in the form of feedback** | | | | |
| A detailed feedback gives me the feeling of being rewarded for my efforts. | 3.94 | 1.20 | 1 | 5 |
| A brief feedback gives me the feeling of being rewarded for my efforts. | 2.53 | 1.28 | 1 | 5 |
| A detailed feedback motivates me. | 3.89 | 1.12 | 1 | 5 |
| A brief feedback motivates me. (n = 28) | 2.36 | 1.26 | 1 | 5 |
| I prefer feedback at short, regular intervals. | 3.53 | 0.76 | 2 | 5 |
| Feedback after completion of a full learning unit is enough for me. | 2.89 | 1.10 | 1 | 5 |
| I would like to be able to determine the extent of the feedback in an e-learning application by myself. | 3.50 | 1.26 | 1 | 5 |
| I would like to be able to determine the timing of the feedback in an e-learning application by myself. | 3.17 | 1.34 | 1 | 5 |
| **The use of transparent, understandable assessment measures** | | | | |
| The assessment system should have a limited number of icons. | 4.17 | 0.76 | 2 | 5 |
| Which form of feedback do you prefer? *Feedback in the form of a text* (n = 10), *Feedback in the form of icons* (n = 9), *Feedback in the form of a text and with icons* (n = 17), *Other* (n = 0) | | | | |

than with a brief feedback (M = 2.53, SD = 1.28). In addition, n = 26 participants (72.22 %) agree that a detailed feedback motivates them (M = 3.89, SD = 1.12).

Together with the findings of the category *Confidence*, this result can be explained by the feedback form: 47.22 % (n = 17) indicate to prefer a combination of icons and textual feedback. Complementing this, the item on the number of icons (M = 4.17) suggests that a limited number is rather or fully preferred by n = 32 participants (88.89 %). Due to the small variation (SD = 0.76), the participants seem to be agreed on this item.

The two items on the individual setting of the feedback show that, if such an option is given, it should rather concern the determination of the extent (M = 3.50, SD = 1.26) than the timing (M = 3.17, SD = 1.34). However, the mean values of these two items also demonstrate that no clear tendencies for the planned e-learning application can be derived from this study.

## DISCUSSION AND CONCLUSION

In the healthcare context, which is characterized by time pressure and constantly new learning content, an appropriately adapted design can help to ensure that managers are more likely to educate themselves further with an e-learning application. Therefore, this study provides first indications

regarding the motivational design of an e-learning application for managers in healthcare. The following recommendations can be derived from the results and used for the further development process of the planned e-learning application:

First, the use of an avatar is a motivating way to convey the learning content. For a higher identification factor, it should be a human one, possibly even offering the opportunity to be individualized by every learner. In their study on fostering motivation in digital games, Birk et al. (2016) come to the conclusion, that people who can identify oneself with their avatar show, among other things, an increasing intrinsic motivation, more commitment and more enjoyment. Second, a personal and informal address seems more likely to motivate learners. However, an individual selection can be provided for this as well in the settings of the e-learning application so that all learners do well with it. Third, the use of audiovisual effects should be reduced as much as possible. Previous research has shown that the use of multimedia, graphics, and animation has a positive effect on learner motivation (e.g. Feng and Tuan 2005). The results concerning the audiovisual effects in this study tend to not confirm this for this target group or show an unclear trend. Since the feedback about the signal tones and the moving graphics does not allow any conclusion, the topics should be evaluated again separately or be adaptable via the settings in the application. Fourth, a detailed feedback with appropriate explanations is rather motivating than a brief feedback. However, based on the mean values of the items on feedback, a brief feedback is not sufficient, while a detailed feedback does not reveal any tendencies whether it should be used for the planned e-learning application. Therefore, further evaluations should be conducted. Nevertheless, to increase the motivation in general, a combination of text and icons should be used and the number of icons should be limited. Feedback generally appears to have a positive effect on motivation (Feng and Tuan 2005); the results of this study still offer a first insight on which type of feedback can be most appropriate for the planned e-learning application in healthcare. The results can be justified by the fact that meaningful feedback is important (Hodges 2004) and should fit the respective learning situation. The assumption that a detailed feedback is therefore perceived as more meaningful is possible. Further studies from other learning contexts have shown that a detailed and a personalized feedback is appreciated as effective (Dawson et al. 2019). Fifth, an explanation of the assessment criteria should not be done successively during the game. When and to what extent this explanation is desirable should be examined in further evaluations. Sixth, a question-and-answer format is more suitable for conveying the learning content within the planned e-learning application in a motivational manner than a classic knowledge preparation.

The results of the evaluated designs of the e-learning application show that the participants rather accept the recommendations based on the ARCS model to increase the stated motivation in general, but not always as comprehensively as expected. On the one hand, this may be due to the diversity of learner preferences and may indicate an adaptable design to address the needs and desires of all managers in healthcare. On the other hand, however, this may also be due to the following limitations.

The significance of the results is limited by the size and the composition of the sample. In future studies, the size should be expanded, for example by including participants from other countries. Furthermore, the questionnaire corresponds to a self-assessment of the participants with regard to their motivation and not to a before-and-after comparison of the motivation within a learning process with and without components of the ARCS model (e.g. Feng and Tuan 2005). In addition, the assessment of motivation always takes place indirectly linked to certain measures, so that less of a direct evaluation is possible (Li and Keller 2018).

The ARCS model has provided a good basis for deriving specific and motivational design recommendations for a healthcare e-learning application. The study allows the derivation of possibly suitable motivational design recommendations for healthcare managers and also indicates which designs should rather be avoided for this target group. In context of the development of an e-learning application, the designers should follow the results of the study to enable a design with a practical orientation and thus create an e-learning offering that motivates managers in healthcare to use it. Keller (2010) recommends that the ARCS model should be considered as part of the development process. Therefore, preliminary design results should be regularly evaluated by potential users and revised accordingly.

## ACKNOWLEDGMENT

The research and development project LUTZ is financed with funding provided by the German Federal Ministry of Education and Research (BMBF) and the European Social Fund (ESF) under the "Future of work" program (funding number: 02L18B535) and implemented by the Project Management Agency Karlsruhe (PTKA). The authors are responsible for the content of this publication. The authors would like to express their gratitude for this support.

## REFERENCES

Birk, M.V., Atkins, C., Bowey, J.T. and Mandryk, R.L. (2016). Fostering Intrinsic Motivation Through Avatar Identification in Digital Games. In: *Proceedings of the 2016 CHI conference on human factors in computing systems*, pp. 2982–2995.

Chang, N.C. and Chen, H.H. (2015). A Motivational Analysis of the ARCS Model for Information Literacy Courses in a Blended Learning Environment. *Libri*, 65(2), pp. 129–142.

Daniel, D. and Wolbrink, T. (2019). Comparison of Healthcare Professionals' Motivations for Using Different Online Learning Materials. *Pediatric Investigation*, 3(2), pp. 96–101.

Dawson, P., Henderson, M., Mahoney, P., Phillips, M., Ryan, T., Boud, D. and Molloy, E. (2019). What Makes for Effective Feedback: Staff and Student Perspectives. *Assessment & Evaluation in Higher Education*, 44(1), pp. 25–36.

Fahrmeir, L., Heumann, C., Künstler, R., Pigeot, I. and Tutz, G. (2016). *Statistik: Der Weg zur Datenanalyse*. 8th ed. Berlin: Springer-Verlag.

Feng, S.L. and Tuan, H.L. (2005). Using ARCS Model to Promote 11th Graders' Motivation and Achievement in Learning about Acids and Bases. *International Journal of Science and Mathematics Education*, 3(3), pp. 463–484.

Hodges, C.B. (2004). Designing to Motivate: Motivational Techniques to Incorporate in E-Learning Experiences. *The Journal of Interactive Online Learning*, 2(3), pp. 1–7.

Keller, J.M. (2010). *Motivational Design for Learning and Performance: The ARCS Model Approach*. New York: Springer Science+Business Media.

Keller, J.M. and Suzuki, K. (2004). Learner Motivation and E-Learning Design: A Multinationally Validated Process. *Journal of Educational Media*, 29(3), pp. 229–239.

Li, K. and Keller, J.M. (2018). Use of the ARCS Model in Education: A Literature Review. *Computers & Education*, 122, pp. 54–62.

Loorbach, N., Peters, O., Karreman, J. and Steehouder, M. (2015). Validation of the Instructional Materials Motivation Survey (IMMS) in a Self-Directed Instructional Setting Aimed at Working with Technology. *British Journal of Educational Technology*, 46(1), pp. 204–218.

Ma, L. and Lee, C.S. (2021). Evaluating the Effectiveness of Blended Learning Using the ARCS Model. *Journal of Computer Assisted Learning*, 37(5), pp. 1397–1408.

Reeves, S., Fletcher, S., McLoughlin, C., Yim, A. and Patel, K.D. (2017). Interprofessional Online Learning for Primary Healthcare: Findings from a Scoping Review. *BMJ Open*, 7(8), e016872.

Shellnut, B., Knowlton, A. and Savage, T. (1999). Applying the ARCS Model to the Design and Development of Computer-Based Modules for Manufacturing Engineering Courses. *Educational Technology Research and Development*, 47(2), pp. 100–110.

Simsek, A. (2014). Interview with John M. Keller on Motivational Design of Instruction. *Contemporary Educational Technology*, 5(1), pp. 90–95.

Vincent-Höper, S., Stein, M., Pohling, U., Felsberg, R., Bobbert, P. and Nienhaus, A. (2020). Arbeitsbelastung im Krankenhaus: Gemeinsam gegen die Ökonomie. *Deutsches Ärzteblatt*, 117(22-23), pp. 1143–1148.

Zaharias, P. (2005). E-Learning Design Quality: A Holistic Conceptual Framework. In: Howard, C., Boettcher, J., Justice, L., Schenk, K., Rogers, P. and Berg, G., eds. *Encyclopedia of Distance Learning*. Pennsylvania: IGI Global, pp. 763–771.

Zander, S. and Heidig, S. (2019). Motivationsdesign bei der Konzeption multimedialer Lernumgebungen. In: Niegemann, H. and Weinberger, A., eds. *Handbuch Bildungstechnologie*. Berlin: Springer-Verlag, pp. 393–415.