Construction of a Questionnaire to Measure the Learner Experience in Online Tutorials

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Abstract: Online tutorials are efficient tools to support learning. They can be easily delivered over company web pages or common video platforms. In commercial contexts, they have the potential to reduce service load, replace product documentation, allow customers to explore more complex products over free trials, and ultimately simplify the learning process for customers. This can lead to increased customer satisfaction and loyalty. But if tutorials are not well-designed, then these goals can not be achieved. Therefore, it is important to be able to measure the satisfaction of learners with a tutorial. We describe the construction of a questionnaire that measures the learner experience with tutorials. The questionnaire was developed by creating a set of candidate items, which were then used by participants in a study to rate several tutorials. The results of a principal component analysis suggests that two components are relevant. The items in the first component (named *Structural Clarity*) describe that a tutorial is well-structured by a logical sequence of steps that are easy to follow and understand. The second component (named *Transparency*) refers to the way the tutorial communicates the underlying learning goals, prerequisites, and concepts and how they can be applied in practice.

1 INTRODUCTION

Online tutorials are an efficient method for knowledge transfer and are therefore frequently used in many different domains (Van der Meij and van der Meij, 2013). For example, to explain how to operate (e.g., how to use a TV remote control), maintain (e.g., how to change the SIM card of a smart phone), or repair (e.g., how to replace defective parts) technical devices, how to work efficiently with established software products (e.g., how to perform typical not fully intuitive tasks with MS Excel or MS Word) or how to do special tasks in a programming environment (e.g., tutorials concerning web development on platforms like SelfHTML).

Previous works have investigated the use of online tutorials for learning in knowledge and problem solving transfer (Mayer, 2005; Mautone and Mayer, 2001). The design and use of tutorials in websites or applications are relevant for the learnability (Nielsen, 2012) and efforts to enhance the user experience by following a human-centered design approach (Husseniy et al., 2021).

The term *tutorial* is used in various contexts. In this paper, we focus on instructional materials that teach specific skills or the ability to perform specific tasks with products in a sequence of steps without the assistance of an instructor or the ability to ask questions in a community. Larger online courses covering general topics or concepts, as well as pure documentation, are not considered in this study, although distinguishing such approaches from tutorials can sometimes be challenging.

Steps of tutorials often include demonstrations, detailed examples or exercises that helps the learner to understand the topic covered by the tutorial. They can be pure video tutorials or textual step-by-step descriptions in a web-page (which are often supported by illustrations or even interactive elements to try out certain aspects) or a combination of these techniques.

Tutorials have a variety of interesting use cases. However, their effectiveness relies on their ability to support users in their learning tasks. This means that tutorials must be well-designed, engaging, and easy to understand. If this is not the case, a tutorial may have

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a negative impact on the market success of a product.

Let us look at some examples to explain this in more detail. A tutorial is often the first contact of a user with a product, for example, software developers often use tutorials offered on free trial versions of cloud platforms to decide if they want to use this platform for a project. If the tutorials are not helpful they might switch to another platform. Customers often search for tutorials in the web if they have an issue with a product and do not want to call the support. If a tutorial offered by the manufacturer does not help to solve the issue this can cause anger and a loss of loyalty.

It is important to note that different persons may have varying opinions regarding the quality of a tutorial, i.e. the perception of learner experience is purely subjective, which is similar to the concept of user experience (Schrepp, 2021). To gain a better understanding of different opinions, it is thus necessary to gather feedback from larger groups of learners. Online questionnaires are an efficient tool for this purpose. They can be placed at the end of a tutorial or triggered when the learner completes the tutorial or reaches a certain point in the tutorial.

We describe in this paper the development of a questionnaire to measure the perceived subjective experience of learners with a tutorial. Such a questionnaire can be used to continuously measure the learner experience and therefore act as an element for quality control.

2 TYPICAL APPLICATION SCENARIOS FOR TUTORIALS

There are several typical usage scenarios for tutorials, especially in the commercial context.

Online tutorials empower customers to find answers to their questions and troubleshoot issues on their own. This reduces the need to reach out to customer support (Hsieh, 2005). Thus, online tutorials can help to reduce support calls and thus saves resources in customer support. Such tutorials are a cost-efficient way to train users (Van der Meij and van der Meij, 2013). However, a badly realized tutorial can cause quite negative emotions towards a product or vendor. Thus, a bad learner experience can negatively impact the learners willingness to use or purchase a product (Beaudry and Pinsonneault, 2005; Venkatesh et al., 2003). For example, for mobile online games an effect of the tutorial quality to user adoption was found (Zhiyong et al., 2021).

Tutorials provide step-by-step instructions accompanied by visual aids such as videos, images, and interactive elements. Good online tutorials foster a sense of interactivity. Users can actively participate in the learning process, following along with the instructions, trying out examples, and receiving immediate feedback. Thus, online tutorials are often more attractive than traditional documentation. But tutorials are often hard to adjust to changes (especially if they contain videos) and have thus a high risk to be outdated. Tutorials can also be perceived by users as disruptive and are often skipped and forgotten (Laubheimer, 2023).

Tutorials are massively used to support customers with engaging learning materials, for example, the Microsoft support page contains a huge number of short tutorials (in most cases a short video accompanied with a step-by-step textual description) that demonstrate features of Microsoft products.

Offering free cloud-based demo systems or time-limited free downloads for commercial software can be an effective strategy to support sales. However, granting free access to a product may not be enough, particularly for more complicated products that require some knowledge to fully explore their capabilities. Users who lack prior knowledge may struggle or overlook certain usage scenarios and features if they explore the product on their own. To address this, tutorials play a crucial role in guiding users and showcasing the product's potential functionalities, making them a valuable marketing tool. A prominent example are cloud platforms, for example *Amazon Web Services*, *IBM Cloud Platform*, *Microsoft Azure* or *SAP Business Technology Platform*. They all offer developers free trial accounts and support learning by many tutorials that help to explore the product features in a guided and easy to understand sequence.

Thus, good online tutorials allow customers to familiarize themselves with specific topics comfortably with low effort. They are available 24 hours, allowing customers to access information at their convenience. This eliminates the need to wait for customer support agents to be available or endure long hold times. Customers can access tutorials whenever they encounter an issue, empowering them to resolve problems quickly and efficiently. That means they can help to increase customer satisfaction and loyalty.

3 REQUIREMENTS FOR THE TUTORIAL QUESTIONNAIRE

There are several papers that evaluate tutorials in certain domains using surveys with some ad hoc formulated questions, for example (Brill and Park, 2011). Our goal is to create a standardized questionnaire that

can be used for many tutorials and is thus able to produce comparable results. Thus, the items in the questionnaire should not be too specific and should not relate to aspects of a tutorial that are only relevant in some special areas.

A tutorial questionnaire can be used to constantly evaluate running online tutorials. For example, by a feedback link placed at the end of the tutorial or a dialog that asks for feedback launched at special events in the tutorial or after a specific delay from the starting point of the tutorial.

It is important that the questionnaire does only contain a small number of items and can thus be completed fast by the learners. There are two main reasons for this:

- Many tutorials are rather short. The time spent on feedback must be somehow proportional to the duration of the tutorial.
- Tutorials are typically only visited once. Thus, users expect no benefit from their feedback. This is different to products that are used frequently, since in this case users assume that their feedback contributes to product improvements in the near future and is thus potentially beneficial for themselves. Therefore, the motivation to provide feedback will be lower than that for a usual product experience questionnaire.

Thus, a questionnaire with a huge number of items will often be not completed and result in a high dropout rate (Schrepp, 2024). This will reduce the number of feedback collected and may also impact a bias, since mainly very satisfied or dissatisfied learners may be motivated to complete the questionnaire.

4 CONSTRUCTION PROCESS

We follow a classical process of questionnaire development in UX (Schrepp, 2021). Several established UX questionnaires are constructed accordingly to this method, for example, SUMI (Kirakowski and Corbett, 1993), AttrakDiff2 (Hassenzahl et al., 2003), UEQ (Laugwitz et al., 2008) or VISAWI (Moshagen and Thielsch, 2010).

1. Select a larger initial set of candidate items that describe aspects of tutorial quality and have a common format.
2. Collect a data set. A larger sample of participants rates various online tutorials with all candidate items.
3. Analyse the data by principal components analysis (Pearson, 1901; Hotelling, 1933). Determine the number of components required to explain the variance in the data sufficiently.
4. Choose the most relevant components as scales and per scale determine the items with the highest loadings on the underlying component as items for the questionnaire.

4.1 Creation of Candidate Items

To create an initial list of items several research papers describing the impact of different quality aspects on the perceptions of overall learner experience were analyzed.

Tutorials typically use step-by-step instructions to demonstrate important features, task flows or concepts of a product. However, if this step-by-step explanation does not work as described the learner is quickly lost and frustrated (Mirhosseini and Parnin, 2020).

There are multiple reasons that can cause such effects, for example, missing or poorly written instructions, or that the tutorial is simply outdated. In addition, it is important that the tutorial (especially longer tutorials) is encouraging and interesting to follow. This is somehow related to the usage of different presentation techniques, for examples videos, interactive diagrams, or executable code snippets (Head et al., 2020). Other problems can result from ignoring learners' prior knowledge respectively not stating clearly what knowledge level is assumed for starting a tutorial (Kim and Ko, 2017). In addition, practice and sufficient feedback helps learners to follow interactive tutorials (Kim and Ko, 2017). Another important point is the length of a tutorial (Lamontagne et al., 2021). If a video tutorial is long and covers a complex topic, this can result in a high cognitive load for the learner. In such cases it makes sense to split the tutorial into several less complex and shorter parts (Spanjers et al., 2011).

In addition to scientific papers, there is a wealth of information on the web on how to create a "good" tutorial. Several blog posts or even "tutorials on how to write a good software tutorial" exist. Extensive research for guidelines and tips was done in the web. Quality aspects of "good" tutorials were collected and then condensed into several statements (in English).

This initial list of statements was reviewed concerning their formulations and potential duplicates were removed. Then the remaining statements were further consolidated concerning their formulations until an agreed version was reached. This resulted in the following list of candidate items:

- Q1: The content of the tutorial fits my needs.

- Q2: The tutorial contains only relevant information.
- Q3: I am satisfied with the duration of the tutorial.
- Q4: In my opinion the tutorial is well-structured.
- Q5: The content of the tutorial is easy to understand.
- Q6: The duration and preconditions of the tutorial are as expected.
- Q7: It is interesting to work through the tutorial.
- Q8: The tutorial motivates me to learn more about this topic.
- Q9: The language used in the tutorial is simple and free of jargon.
- Q10: Technical terms are adequately explained.
- Q11: The tutorial is divided into manageable steps that form a logical sequence.
- Q12: It is clearly stated at the beginning of the tutorial what learners will achieve.
- Q13: The tutorial includes practical examples and demonstrations.
- Q14: Visuals like images, diagrams, and videos are used to explain complex concepts.
- Q15: The content of the tutorial is up to date.
- Q16: The tutorial explains not just how to do something, but why it's done that way.
- Q17: All steps in the tutorial worked exactly as described.
- Q18: Required prerequisites for the tutorial are explained at the start of the tutorial.
- Q19: The tutorial is easy to follow.
- Q20: The examples given in the tutorial are practically relevant.
- Q21: The tutorial covers all the features I am interested in.
- Q22: The pace of the tutorial is appropriate.

Since the data for the construction process were collected in Indonesia, the items were translated carefully to Indonesian language. Translations were reviewed independently by several native speakers and some adjustments were performed in an iterative process until an agreed translation was reached. The Indonesian translations are contained in the Appendix of this paper.

4.2 Data Collection

4.2.1 Participants

The participants were undergraduate students. They come from various faculties of science and engineering, particularly computer science, from a number of universities spread across several provinces in Indonesia including Jakarta, West Java, and Bengkulu.

The students were contacted over email. Around 300 students were contacted and 117 (61 male, 55 female, 1 unknown, average age: 21.23 years, standard deviation 3.97 years) responded and filled out the questionnaire. Participation in the study was entirely voluntary.

4.2.2 Rated Tutorials

The participants could select one of seven different tutorials that describe how to use the following common applications:

- SATUSEHAT: A mobile application designed to provide comprehensive health services and information, ensuring a continuum of care for Indonesia's citizens. By standardizing and integrating electronic medical records, this platform connects various health information systems.
- DJP Online: A service managed by Indonesia's Directorate General of Taxation (Direktorat Jenderal Pajak Republik Indonesia), offering a range of tax-related applications and services for tax filers.
- Shopee: A well-known e-commerce platform in Indonesia, where shoppers can conveniently find a wide range of products, including clothes, electronics and other products, via this application. This platform can be accessed both as a website and a mobile app.
- Gojek: An app providing a range of on-demand services including transportation and food delivery, where tutorials on how to use Gojek are generally accessible. The products of Gojek consist of Transport and Logistics, Payments, Food and Shopping as well as Business.
- Bukalapak: Another widely used e-commerce platform in Indonesia, allowing users to purchase or sell both new and second-hand items via this application. Anyone in Indonesia has the opportunity to sell their products on Bukalapak by establishing an economical online storefront, which accommodates both single item and wholesale shopping systems.

- Tokopedia: A digital shopping application providing a wide range of products from various categories, with extensive Tokopedia instruction guides readily accessible. Tokopedia's online marketplace delivers products through various channels, including Marketplace, Official Stores, Instant Commerce, Interactive Commerce, and Rural Commerce, catering to a wide range of consumer needs.
- Traveloka: A platform designed for booking flights, hotels, buses and travels, train tickets and other services. Traveloka offers comprehensive tutorials to assist users in planning their trips more effectively.

These tutorials were selected because the corresponding products are very popular among the target group and we could therefore assume that the students we contacted knew at least one of these products and had watched a corresponding tutorial.

4.2.3 Survey

The participants receive an email with a short motivation and a link to open the survey.

The survey starts with a short instruction, followed by two questions concerning age and gender of the participant. Below these fields the participants could select the tutorial they want to rate from a selection field showing all the 7 alternatives.

Below this selection the 22 candidate items were shown. Each item had a 7-point response scale with the endpoints *Fully Disagree* and *Fully Agree*. After the last item a button to submit the response was shown.

The survey can be completed within a timeframe of five to ten minutes.

4.3 Analysis of the Data

A principal component analysis with varimax rotation was performed. Figure 1 shows the eigenvalues of the potential components. The higher the eigenvalue is (they are shown in order from largest to smallest), the higher is the predictive value of this component.

Accordingly, to the scree-test (Cattell, 1966) (determine the point after which eigenvalues differ only slightly) and the Kaiser-Gutmann criterion (Guttman, 1954) (remove components with eigenvalues smaller than one) two components could be identified and are chosen as scales. These two components represent 73% of the variance in the data. A commonly used rule is to retain enough components to explain more than 70% of the variance in the original data (Jolliffe and Cadima, 2016). Thus, our two component solution seems to be a reasonable choice.

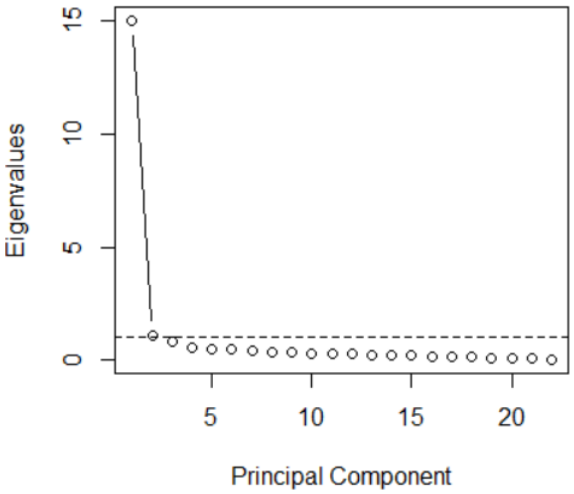

Figure 1: Scree plot of the eigenvalues. The dashed line shows the cutoff value for the Kaiser-Gutmann criterion.

We decided to choose 4 items per component for the first version of the questionnaire. Therefore, the 4 items with the highest loading on the corresponding components (see Table 1 in the Appendix) were selected. Commonly used heuristic consider component loadings greater than 0.4 as generally acceptable, see (Comrey and Lee, 2013). The loadings of our selected items are all above 0.7, and can be thus savely be considered as good representations of the components.

The items with the highest loading on the first component were Q4, Q5, Q11 and Q19. These items are shown below:

- In my opinion the tutorial is well-structured.
- The content of the tutorial is easy to understand.
- The tutorial is divided into manageable steps that form a logical sequence.
- The tutorial is easy to follow.

They describe that a tutorial is well-structured in a logical sequence that is easy to follow and understand. We name this scale therefore *Structural Clarity*.

The items with the highest loadings on the second component are Q12, Q13, Q16, and Q18. These items are shown below:

- It is clearly stated at the beginning of the tutorial what learners will achieve.
- The tutorial includes practical examples and demonstrations.
- The tutorial explains not just how to do something, but why it's done that way.

- Required prerequisites for the tutorial are explained at the start of the tutorial.

These items refer to the way the tutorial communicates the underlying learning goals, prerequisites, and concepts and how they can be applied to practice. So somehow they describe that the tutorial makes its purpose transparent to the learner. Therefore, we call this scale *Transparency*.

The Cronbach-Alpha (Cronbach, 1951) values are 0.95 for the structural clarity scale and 0.89 for the transparency scale indicating a high internal scale consistency.

The first four items form the scale *Structural Clarity*, while the last 4 items form the scale *Transparency*. The answers are coded from -3 (Fully disagree) to +3 (Fully agree), thus a 0 represents a neutral evaluation. The scale score for *Structural Clarity* respectively *Transparency* is calculated as the mean over all items in the scale and all participants of a study. The overall tutorial quality score is the mean of the scale scores for *Structural Clarity* and *Transparency*. Thus, the questionnaire reports an overall score and two scores for the sub-scales.

5 LIMITATION AND OUTLOOK

We described the development of a standard questionnaire to measure tutorial quality. Of course, a sound validation of the questionnaire concerning reliability and validity as well concerning its ability to differentiate between tutorials of different quality must be evaluated in further studies.

Data collection for the construction was done in Indonesia. Of course, it must be checked if there were any culture specific influences that had an impact on the selection of items. This is not really likely, we know for example that the impact of cultural background on the importance of UX quality aspects is relatively low (Santoso and Schrepp, 2019). In addition, the investigated tutorials do of course not cover the full range of tutorials concerning length, complexity or topics. Thus, the scale structure must be confirmed by repeating the study in different countries and with different types of tutorials. The results presented in this paper are just the first step in the construction process.

Currently, the questionnaire is available in English and Indonesian language. It is planned to develop further translations and to make the questionnaire as well as the translations available to researchers over a dedicated website that allows to view and download the material.

REFERENCES

Beaudry, A. and Pinsonneault, A. (2005). Understanding user responses to information technology: A coping model of user adaptation. *MIS quarterly*, pages 493–524.

Brill, J. and Park, Y. (2011). Evaluating online tutorials for university faculty, staff, and students: The contribution of just-in-time online resources to learning and performance. *International Journal on E-learning*, 10(1):5–26.

Cattell, R. B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research*, 1(2):245–276.

Comrey, A. L. and Lee, H. B. (2013). *A first course in factor analysis*. Psychology press.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3):297–334.

Guttman, L. (1954). Some necessary conditions for common-factor analysis. *Psychometrika*, 19(2):149–161.

Hassenzahl, M., Burmester, M., and Koller, F. (2003). AttrakDiff: Ein Fragebogen zur Messung wahrgenommener hedonischer und pragmatischer Qualität. *Mensch & Computer 2003: Interaktion in Bewegung*, pages 187–196.

Head, A., Jiang, J., Smith, J., Hearst, M. A., and Hartmann, B. (2020). Composing flexibly-organized step-by-step tutorials from linked source code, snippets, and outputs. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, pages 1–12.

Hotelling, H. (1933). Analysis of a complex of statistical variables into principal components. *Journal of Educational Psychology*, 24(6):417–441.

Hsieh, C. (2005). Implementing self-service technology to gain competitive advantages. *Communications of the IIMA*, 5(1):77–83.

Husseniy, N., Abdellatif, T., and Nakhil, R. (2021). Improving the websites user experience (ux) through the human-centered design approach (an analytical study targeting universities websites in egypt). *Journal of Design Sciences and Applied Arts*, 2(2):24–31.

Jolliffe, I. T. and Cadima, J. (2016). Principal component analysis: a review and recent developments. *Philosophical transactions of the royal society A: Mathematical, Physical and Engineering Sciences*, 374(2065).

Kim, A. S. and Ko, A. J. (2017). A pedagogical analysis of online coding tutorials. In *Proceedings of the 2017 ACM SIGCSE Technical Symposium on Computer Science Education*, pages 321–326.

Kirakowski, J. and Corbett, M. (1993). The software usability measurement inventory. *British Journal of Educational Technology*, 24(3):210–212.

Lamontagne, C., Sénécal, S., Fredette, M., Labonté-LeMoyne, É., and Léger, P.-M. (2021). The effect of the segmentation of video tutorials on user's training experience and performance. *Computers in Human Behavior Reports*, 3.

Laubheimer, P. (2023). Onboarding tutorials vs. contextual help, https://www.nngroup.com/articles/onboarding-tutorials/ (last accessed: April 9, 2024).

Laugwitz, B., Held, T., and Schrepp, M. (2008). Construction and evaluation of a user experience questionnaire. In *HCI and Usability for Education and Work: 4th Symposium of the Workgroup Human-Computer Interaction and Usability Engineering of the Austrian Computer Society, USAB 2008, Graz, Austria, November 20-21, 2008. Proceedings 4*, pages 63–76. Springer.

Mautone, P. D. and Mayer, R. E. (2001). Signaling as a cognitive guide in multimedia learning. *Journal of educational Psychology*, 93(2):377–389.

Mayer, R. E. (2005). *The Cambridge handbook of multimedia learning*. Cambridge university press.

Mirhosseini, S. and Parnin, C. (2020). Docable: Evaluating the executability of software tutorials. In *Proceedings of the 28th ACM Joint Meeting on European Software Engineering Conference and Symposium on the Foundations of Software Engineering*, pages 375–385.

Moshagen, M. and Thielsch, M. T. (2010). Facets of visual aesthetics. *International Journal of Human-Computer Studies*, 68(10):689–709.

Nielsen, J. (2012). Usability 101: Introduction to usability, https://www.nngroup.com/articles/usability-101-introduction-to-usability/ (last accessed: April 9, 2024).

Pearson, K. (1901). On lines and planes of closest fit to systems of points in space. *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science*, 2(11):559–572.

Santoso, H. B. and Schrepp, M. (2019). The impact of culture and product on the subjective importance of user experience aspects. *Heliyon*, 5(9).

Schrepp, M. (2021). *User Experience Questionnaires: How to use questionnaires to measure the user experience of your products?* KDP, ISBN-13: 979-8736459766.

Schrepp, M. (2024). Designing and analyzing questionnaires and surveys. In *User Experience Methods and Tools in Human-Computer Interaction*, pages 121–169. CRC Press.

Spanjers, I. A., Wouters, P., Van Gog, T., and Van Merrienboer, J. J. (2011). An expertise reversal effect of segmentation in learning from animated worked-out examples. *Computers in Human Behavior*, 27(1):46–52.

Van der Meij, H. and van der Meij, J. (2013). Eight guidelines for the design of instructional videos for software training. *Technical communication*, 60(3):205–228.

Venkatesh, V., Morris, M. G., Davis, G. B., and Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, pages 425–478.

Zhiyong, X., Jiani, W., and Lijun, J. (2021). How game tutorials in mobile online games affect user adoption. In *2021 10th International Conference on Educational and Information Technology (ICEIT)*, pages 264–268. IEEE.

APPENDIX

Indonesian Items

Below the translations for the English items into Indonesian language are shown. These translations were used for data collection.

- Q1: Materi tutorial sesuai dengan kebutuhan saya.
- Q2: Tutorial hanya memuat informasi yang relevan.
- Q3: Saya puas dengan durasi tutorial.
- Q4: Tutorial telah disusun dengan baik.
- Q5: Materi tutorial mudah dipahami.
- Q6: Durasi dan prasyarat yang diperlukan sesuai ekspektasi.
- Q7: Tutorial menarik untuk diikuti.
- Q8: Tutorial memotivasi saya untuk mempelajari lebih banyak hal/materi mengenai topik ini.
- Q9: Bahasa yang digunakan dalam tutorial sederhana dan bebas dari jargon.
- Q10: Istilah teknis dijelaskan dengan cukup memadai.
- Q11: Tutorial disusun dengan tahapan yang logis.
- Q12: Apa yang akan dicapai pengguna aplikasi disampaikan secara jelas di awal tutorial.
- Q13: Tutorial memuat contoh-contoh penerapan dan demonstrasi.
- Q14: Visualisasi seperti gambar, diagram, dan video digunakan untuk menjelaskan konsep yang kompleks.
- Q15: Tutorial memuat konten terkini.
- Q16: Tutorial menjelaskan 'bagaimana' dan 'mengapa' sesuatu perlu dilakukan.
- Q17: Semua tahapan dalam tutorial berjalan sebagaimana yang dijelaskan.
- Q18: Prasyarat yang diperlukan untuk tutorial dijelaskan di awal tutorial.
- Q19: Tutorial mudah diikuti.
- Q20: Contoh-contoh yang diberikan dalam tutorial bersifat praktis dan relevan.
- Q21: Tutorial mencakup semua fitur yang menarik bagi saya.
- Q22: Tutorial dijelaskan dengan tempo yang sesuai.

Loadings from PCA

Table 1: Loadings of the items on the two extracted components.

Item	Component 1	Component 2
Q1	0.771	0.331
Q2	0.750	0.319
Q3	0.762	0.421
Q4	**0.821**	0.345
Q5	**0.872**	0.280
Q6	0.752	0.428
Q7	0.636	0.518
Q8	0.457	0.589
Q9	0.560	0.517
Q10	0.686	0.606
Q11	**0.816**	0.410
Q12	0.457	**0.702**
Q13	0.301	**0.853**
Q14	0.608	0.529
Q15	0.586	0.594
Q16	0.297	**0.801**
Q17	0.594	0.658
Q18	0.280	**0.796**
Q19	**0.793**	0.451
Q20	0.630	0.633
Q21	0.622	0.531
Q22	0.558	0.636

English Questionnaire

In my opinion the tutorial is well-structured.

Fully disagree ○ ○ ○ ○ ○ ○ ○ Fully agree

The content of the tutorial is easy to understand.

Fully disagree ○ ○ ○ ○ ○ ○ ○ Fully agree

The tutorial is divided into manageable steps that form a logical sequence.

Fully disagree ○ ○ ○ ○ ○ ○ ○ Fully agree

The tutorial is easy to follow.

Fully disagree ○ ○ ○ ○ ○ ○ ○ Fully agree

It is clearly stated at the beginning of the tutorial what learners will achieve.

Fully disagree ○ ○ ○ ○ ○ ○ ○ Fully agree

The tutorial includes practical examples and demonstrations.

Fully disagree ○ ○ ○ ○ ○ ○ ○ Fully agree

The tutorial explains not just how to do something, but why it's done that way.

Fully disagree ○ ○ ○ ○ ○ ○ ○ Fully agree

Required prerequisites for the tutorial are explained at the start of the tutorial.

Fully disagree ○ ○ ○ ○ ○ ○ ○ Fully agree

Indonesian Questionnaire

Tutorial telah disusun dengan baik.

Sangat tidak setuju ○ ○ ○ ○ ○ ○ ○ Sangat setuju

Materi tutorial mudah dipahami.

Sangat tidak setuju ○ ○ ○ ○ ○ ○ ○ Sangat setuju

Tutorial disusun dengan tahapan yang logis.

Sangat tidak setuju ○ ○ ○ ○ ○ ○ ○ Sangat setuju

Tutorial mudah diikuti.

Sangat tidak setuju ○ ○ ○ ○ ○ ○ ○ Sangat setuju

Apa yang akan dicapai pengguna aplikasi disampaikan secara jelas di awal tutorial.

Sangat tidak setuju ○ ○ ○ ○ ○ ○ ○ Sangat setuju

Tutorial memuat contoh-contoh penerapan dan demonstrasi.

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Tutorial menjelaskan 'bagaimana' dan 'mengapa' sesuatu perlu dilakukan.

Sangat tidak setuju ○ ○ ○ ○ ○ ○ ○ Sangat setuju

Prasyarat yang diperlukan untuk tutorial dijelaskan di awal tutorial.

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