The Relationship Between Metacognitive Experiences and Digital Literacy in a Self-Directed Learning Environment

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Abstract. The learning environment in universities that use a learning management system requires students to study independently. This study investigates a digital literacy assessment model with additional instruments from a knowledge management perspective. The model has been tested on 50 students in the Department of Library Science, University of Diponegoro, who were selected using a purposive sampling technique. The results of the assessment were analyzed using regression and showed that metacognitive was the dominant predictor.

1 Introduction

Online lectures in the post-pandemic era, are carried out through various types of software/platforms. The types of software used include software for learning management systems, collaboration software, or video conferencing software. Learning management system is a software specially designed to organize virtual learning/classes, and it includes features for enrollment, quiz and exam features, task file management, along with the assessment system. This type of software includes Google Classroom and university-owned e-learning portals. While the second type of software, which is intended for work collaboration, includes Microsoft Teams. And the third type is software for video conferencing purposes, among others, which are widely used during distance learning including, Zoom, Google Meet, Visco Webex, to Whatsapp Group. The method change is quite drastic and the only option available is to hold lectures virtually, where face-to-face in class is replaced face-to-face via virtual and involves digital technology. In a college environment, lecturers and students are required to hold virtual classes and meetings on one of the platforms and software mentioned above. The preparation was carried out in a very short time and without formal socialization. One of the key factors in changing the lecture method is the competence of lecturers and students in using technology to manage the distance learning process. This ability is part of digital literacy, which can be interpreted as the ability to use and manage technology, information and communication systems.Metacognition is a means to think deeper, at a higher level of abstraction. It also results in efficiency in thinking and learning. Conceptualization at a higher level of

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abstraction broadens the scope of application and transfer of ideas and understanding. There is a growing literature on the importance of metacognition in learning.

Literally, digital literacy can be defined by lowering the definition of the words 'literacy' and 'digital'. Literacy is defined as the ability to read and write, while digital can be interpreted as a written and reading format that is on a computer. When put together, digital literacy can be defined as the ability to operate a computer to read and write in digital format. Another articles defines digital literacy as the ability to understand and use information in various formats (text, images, audio, video, and animation) and from various sources that are presented through electronic devices. Meanwhile, according to Deakin University's Graduate Learning Outcome 3 (DU GLO3), digital literacy is defined as the use of technology to find information, use that information as thought input, and disseminate enriched information, through digital platforms. Thus, digital literacy also involves the ability to understand, analyze, evaluate various information received, and evaluate the information.

The ability to think critically in the context of problem solving, especially in elementary schools, is associated with scientific literacy skills. Scientific literacy ability is a technique in using scientific knowledge, identifying questions, and drawing conclusions based on evidence in order to understand and make decisions regarding its nature and changes due to human activities. In this context, it is intended for all people regardless of whether they will become scientists or non-scientists in the future. The problem-solving process using logical thinking is associated with metacognitive abilities in scientific literacy. Metacognitive ability is a high-level ability about how to think which includes cognitive knowledge and cognitive experience. Cognitive knowledge is knowledge about cognitive processes that are useful in controlling cognitive processes. While cognitive experience is a process taken to control an activity and the purpose of the cognitive existence.

The process of metacognition is in line with the logic of the new media. James Gee argues that computer games require meta-level thinking about the semiotic domain – it's not enough to just play games; to play it well you must develop an understanding of the underlying architectural and design principles. New media cannot be 'read', page after page; they require an understanding of navigation schemes and information architecture. Meanwhile, in education, didactic pedagogy operates in a single layered flat epistemic world, cognition: information that can be remembered, routines by which correct answers can be inferred, and application of correct concepts. Metacognition adds a second layer of thinking, in the same order as the new media navigation architecture. This layer consists of a meta-understanding of the nature of disciplinary practice. This layer is generative, supporting the transfer of understanding across contexts, including undiscovered contexts. It also supports mnemonic work, using tools to help remember (tags, annotations, coding, bookmarks) that refer to more general levels of meaning.

As an example of a supportive learning media, we took the example of student peer review of written science arguments. In revising their arguments in providing feedback to their peers, students may be asked to analyze whether a claim is sufficiently supported by evidence, and thus consider the nature of the relationship between claims and evidence in science. This creates a dialectical play between first-order cognition (thinking about climate change or hydraulic fracking, perhaps), and second-order reflective thinking about the ways in which valid scientific claims must be supported by evidence. In this formative assessment process, students externalize and analyze their written representations of science against certain criteria, becoming more analytic in their scientific thinking. Munford and Zembal-Saul summarize the benefits of metacognitive for students: opportunities to learn, not only content but also about disciplinary theory and processes, including an understanding of the role of documentary knowledge representation and social interaction in the knowledge construction process; engagement with discourse that makes learners' understanding and

thinking visible, thereby providing a valuable tool for reflection and assessment; and support for developing different ways of thinking and increasing understanding of disciplinary ideas.

2 Material and Method

This type of research is experimental research. This study used a quasi-experimental research design carried out using a nonequivalent post-test only control group design. The research implementation process is grouped into the experimental class and the control class. In this study, a random sampling technique will be used with randomized classes as intact groups. The data collection method used is the questionnaire method and the test method. Questionnaires were used to measure literacy skills. The research location was in 3 faculties at Diponegoro University, in a distance learning situation with a total of 150 students as respondents. This study is an extension of research on digital literacy among students, by adding variables that are related to metacognitive and the affection of students, namely Overviewing and Reflection. Table 1 shows the measured variables for the digital literacy ability group, then in table 2 the variables related to metacognitve are presented.

Table 1. List of variable in digital literacy ability

Indicator	Aspect
Operation	Cognitive
	Discovery
	Presentation
Thinking	Analysis
	Evaluation
	Creativity
Collaboration	Teamwork
	Networking
	Knowledge Sharing
Awareness Skills	Ethics
	Law and compliance

Table 2. List of variable in metacognitive experience

Indicator	Aspect
Discipline and initiative	Comprehension of concept
	Task Demands
	Finding Connections
Confidence and indepence	Examination of the process
	Examination of the result

3 Results

This research designed a assessment model for information literacy, consist of several steps. In the first step are evaluation of abstract texts, to measure how the student familiar with the topic of text and terminology. The answers were measured to the following extent: very familiar, well-known, moderately familiar, unknown. The second step are identify the text topic and the intention of the author. Only students with greater experience in knowledge analysis were needed to complete this level. The third step are identify the overall text structure. The fourth step are identify the key phrase that perform as 'markers'. In the abstract writing process, the procedures are consist of pick the main phrases. This stage allowed us to

realize the significance of the superficial and thus reduce the text to be worked on. Render selected phrases generalized. The goal of this stage was to see how the students rewrote the most relevant sentences chosen in the previous stage, making them more coherent and meaningful for the abstractor. Only students in the final course were required for this portion. Selected and generalized phrases group. This stage aims to reveal students ' ability to associate and put in smaller groups the sentences they have chosen and generalized. Only final-course students needed this stage. Graphical schema planning. During this phase, we observed the type of scheme used by the students and their ability to structure data. Extract and graphically arrange keywords in a concept map. The representation by keywords of a text indicates the abstractor's ability to grasp and interpret and to some degree, to synthesize and to express. Rather than using controlled vocabulary we opted for free choice. Finally, a conceptual plan of the relations between the keywords was also called for by students. Thus, we were able to see the visual organization style and the relationship between selected keywords (whether the word selection was right or not). Abstract writing. This final stage was primarily analyzed from the perspective of speech and synthesis. The following data shows the results of measuring digital literacy skills (in table 2) and abilities related to self-directed learning (in table 3).

Table 2. List of variables in digital literacy ability

Indicator	Aspect	Mean	Category
Operation	Cognitive	82	Good
	Discovery	90	Very Good
	Presentation	86	Very Good
Thinking	Analysis	84	Good
	Evaluation	88	Very Good
	Creativity	92	Very Good
Collaboration	Teamwork	88	Very Good
	Networking	88	Very Good
	Knowledge Sharing	83	Good
Awareness Skills	Ethics	82	Good
	Law and compliance	82	Good

Table 3. List of variables in metacognitive experience

Indicator	Aspect	Mean	Category
Discipline and initiative	Planning	84	Good
	Focus	92	Very Good
	Exploring the material	84	Very Good
Confidence and indepence	Participating	84	Good
	Self Ability	90	Very Good
	Creativity	84	Good

4 Conclusion

The learning environment in universities that use a learning management system requires students to study independently. This study investigates a digital literacy assessment model with additional instruments from a knowledge management perspective. The model has been tested on 50 students in the Department of Library Science, University of Diponegoro, who

were selected using a purposive sampling technique. The results of the assessment were analyzed using regression and showed that metacognitive was the dominant predictor..

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