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Students' Learning Independence and Critical Thinking Ability Using Mobile Learning Technology

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Abstract: 21st-century learning requires teachers and students to integrate literacy skills, scientific literacy, mathematics, reading, writing, and technology in the learning process. Students must have initiative, discipline, responsibility, confidence, motivation for independent learning, and the ability to think critically about the problems presented. This study aims to determine students' autonomous knowledge and critical thinking abilities (CTA) using mobile learning technology (MLT). This research is a quantitative study involving 83 students from four junior high schools in the city of Mataram. The data collection for independent learning and students' CTA was carried out by giving tests and non-tests to students. The test conducted was a written test in the form of a description of 10 questions covering indicators of CTA. The non-test was conducted by giving a student learning independence questionnaire with as many as 15 statements, including five indicators of learning independence. This quantitative research data analysis uses the Rash modeling application with the help of Ministep software. The analysis results show that the learning independence of male and female students in the four junior high schools obtained a percentage of 77.38% in the "good" category. Each indicator of learning independence accepts a percentage above 70%, which is in the excellent category. Meanwhile, the CTA of male and female students from the four junior high schools obtained 75.28% in the "good" category. Each indicator of CTA also gets a percentage of more than 70%, meaning that each indicator is in a good category.

Keywords: *Learning independence, critical thinking ability, mobile learning technology.*

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Introduction

Learning in the 21st century must incorporate technological competence with literacy, knowledge, skills, and attitudes (Marshel & Ratnawulan, 2020; Mutiani & Faisal, 2019; Sarmi et al., 2019). 21st-century learning demands being able to master 21st-century competencies (Bahtiar et al., 2022a; Caena & Redecker, 2019; Huang et al., 2019; Mistiani et al., 2022). The following skills were designated as 21st-century competencies by the Assessment and Teaching of 21st-century skills (ATC21S) Project: (a) a way of thinking that includes innovation, critical analysis, problem-solving, and decision-making, (b) a way of working that emphasizes communication and collaboration, (c) work tools that include information literacy and ICT literacy, and (d) living in the world that emphasizes civic engagement, life and career skills, and local and global citizenship (Hussin et al., 2019).

The requirements for human competence to be able to live, work, and seize opportunities for participation in it are significantly more complex and of high caliber, and this is in addition to the pace of changes and developments that have taken place in the global era, which is vastly different from the age of twenty or thirty years ago (Alghamdi & Al-Ghamdi, 2021; Silber-Varod et al., 2019; Sumardi et al., 2020). 21st-century education and learning must optimize students' competency development, ensuring that participants can live, work, and participate in a 21st-century, knowledge, and global economic society (Aldowah et al., 2019; Bao & Koenig, 2019). The 21st-century learning paradigm places a premium on students' capacities for critical thought, knowledge integration, teamwork, and information and communication technology mastery (Chalkiadaki, 2018; Howard, 2018).

Educational technology is a systemic process in helping to solve lifelong human learning problems (Bond & Bedenlier, 2019; Luckin & Cukurova, 2019; Mangal & Mangal, 2019). Based on the findings of interviews and literature reviews, it is clear that the primary learning issues that frequently cause difficulties in the execution of teacher duties have to do with the process of learning complex concepts, historical events, abstract concepts, and past events. They also have to do

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with providing direct experience and experience interacting with objects that are either too big or too small. The application of the functions of developing, utilizing, and managing resources and technology to improve learning quality in the near term and boost performance as long-term learning outcomes is one way that educational technology can be used to teach 21st-century capabilities (Castañeda & Selwyn, 2018; Granić & Marangunić, 2019)

The use of educational technology can promote the creation of more creative learning systems, the use of goods made possible by scientific and technical advancement to assist learning activities, and the growth of a variety of learning styles (Hawkridge, 2022; Zawacki-Richter et al., 2019). Innovative learning systems have been successfully developed as an applied educational technology, and some have been institutionalized in the national education system (Mulenga & Marbán, 2020). Here presented circles network visualization related to the use of technology in learning.

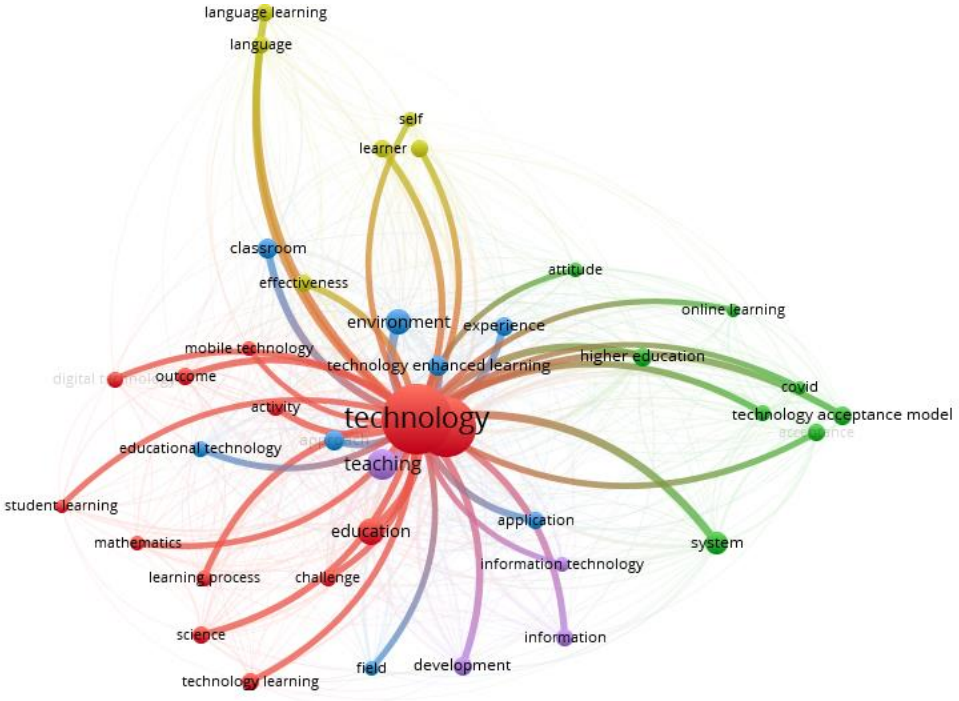

Figure 1. Circles Network Visualization (Bahtiar et al., 2022b)

Figure 1 demonstrates how many teachers have used technology in the teaching and learning process, which is analyzed using a bibliometric. The application of technology is associated with other variables such as learning technology, education, information, learning processes, student learning, online learning, mobile technology, and others. This shows that technology, especially information and communication technology, can keep up with the rate at which science and technology are developing. The use of technology in this learning process must be able to assist someone in being able to master knowledge and technology, making decisions, solving problems, and building specific abilities based on demands (Dhawan, 2020; Joo et al., 2018; Williamson et al., 2020).

Learning independence (LI) is an individual condition in learning that can control learning (Abidah et al., 2020; O.-S. Tan, 2021). With advances in technology, students can find information easily and quickly through their gadgets (Kabanova & Vetrova, 2019; Muyasaroh et al., 2020). The constructivist learning theory emphasizes that students must independently locate and transform complicated knowledge, compare new information to outdated rules, and update those rules when necessary (Slavin, 2019). According to this theory, one of the key ideas in educational psychology is that teachers do not only convey information to their charges. To learn, students must develop their knowledge (Sweller et al., 2019).

The independence of student learning is one of the motivations for facing various challenges and learning tasks (Aytaç, 2021; Rahmatullah et al., 2022). Independent students may accomplish their work or assignments well even without the assistance of others (Noboru et al., 2021). Conversely, students who are not independent are usually less able to complete tasks correctly and always expect help from others or those around them.

Learning independence is very important for the learning process (Xian et al., 2017). By having independence in learning, students can self-awareness to always actively prepare themselves in learning activities, work hard to plan and evaluate their learning activities, can face learning difficulties, and do not need the help of others in learning (Brockett & Hiemstra, 2018; Leibo et al., 2017). Students who have learning independence are reflected in terms of not being easily influenced by other people, not running or avoiding problems in learning, being able to solve problems on their own without the help of others, studying diligently and disciplined, being able to be responsible for their learning activities, and having a critical attitude in the study. This is by research conducted by Arista and Kuswanto (2018), which states that students

with high learning independence can solve problems by involving reflective and analytic thinking processes without guidance.

The ability to critically analyze or investigate an idea or ideas after understanding an idea or ideas is known as critical thinking ability (Changwong et al., 2018; Cottrell, 2017; Fuad et al., 2017). A person who thinks critically can ask appropriate questions, gather relevant information, act efficiently and creatively based on the information, present logical arguments based on information, and draw credible conclusions (Bahtiar et al., 2022c; Gunawan et al., 2021; Widana et al., 2018). CTA will stimulate students' cognitive reasoning in acquiring knowledge (Muali et al., 2018; Paul & Elder, 2005). Students' critical thinking is essential because, during the learning process, students develop ideas and thoughts about the problems contained in learning (Bahtiar et al., 2016; Ghanizadeh, 2017).

Critical thinking is one of the skills that kids need to develop from an early age. Officials in Singapore, which has some of the world's top literature, math, and science programs, are debating bringing critical thinking lessons into the kindergarten classroom. They believe critical thinking must be taught in schools as a separate subject (L. S. Tan et al., 2017). Critical thinking abilities can enhance conceptual knowledge and help pupils build their problem-solving abilities, especially during learning (Anazifa & Djukri, 2017; Pratama & Retnawati, 2018). When working on student problems, it is inseparable from the thought process, where students try to find ways of how they can solve and find solutions to these problems. The results of interviews with one of the teachers at a junior high school in the city of Mataram showed that students learned the material only according to what was taught by the teacher, which was more procedural (Retnawati et al., 2018; Tanujaya et al., 2017). In addition, so far the tendency of students is only to focus on memorization, they only think that by memorizing the material can find solutions to problems. In fact, it may not necessarily be realized (Bahtiar & Ibrahim, 2022; Boholano, 2017; Maimun & Bahtiar, 2022). This causes students' CTA not to develop optimally. Research conducted by Bahtiar et al. (2022b) students' critical thinking skills are low because learning is delivered without using interesting learning media and the learning used has not facilitated students to think logically. However, this previous research has advantages in terms of using instructional media that facilitate students to think critically.

Applying the principles of educational technology, such as using pertinent media in the learning process, creating appropriate learning models based on student characteristics and the competencies to be attained, and utilizing a variety of available learning resources, can help solve learning problems in this situation. Applying the philosophy and practice of educational technology can help solve learning issues that arise in space-themed classroom settings. Research conducted by Maimun and Bahtiar (2022) and several previous studies have only focused on the use of instructional media in general. In addition, research conducted by Retnawati et al., 2018 also focused on critical thinking skills without measuring student learning independence after using applied learning media. Therefore, the purpose of this study is to determine students' learning independence and critical thinking ability using mobile learning technology (MLT). The independence of student learning has an impact on the results of students' critical thinking abilities. This research is expected to contribute to schools, teachers, and researchers in implementing technology-based learning to measure students' competencies.

Methodology

Research Design

Research on learning independence and students' CTA in learning using MLT was a quantitative study. The researcher in this study offered quantitative data, i.e., the outcomes of statistical computations and analysis pertaining to the variables of learning independence and students' CTA. This type of quantitative research is designed with the aim of developing and using mathematical models, theories, and hypotheses related to a phenomenon. In research on learning independence and students' CTA in learning using MLT through quantitative research methods, it is described based on gender, school origin, and indicators for each variable. MLT was developed by Android-based researchers with iSpring Suite software. Before MLT is used in research, it is first validated by media experts. The results of the revised validation are then used in learning. The use of MLT media in learning for four meetings. This MLT contains "*Zuhud and Tawakkal"* (immaterialism and leaving everything in Allah's hands) sub-materials. MLT must first be installed by students on their android. Once installed, students can use MLT anywhere. Then through blended learning, teachers can show MLT to students too. Students can also use MLT anywhere.

Population and Sample

The population is the total number of respondents studied. The research on learning independence and students' CTA in learning using MLT involved eighth-grade junior high school students in the city of Mataram with a total of 300 students. The junior high schools involved were 4 accredited B junior high schools. The research sample used was calculated based on the Slovin's formula (Novansa & Ali, 2017). The results of the Slovin calculation obtained respondents as many as 83 students. The research sample can be seen based on gender and school origin. The following is a sample based on gender.

Table 1. Distribution of Sample by Gender

Gender	Male		Female	
	F	%	F	%
Variable	37	44.57	46	55.42

Table 1 above shows that 37 students (44.57%) in the research sample were male students and 46 students (55.42%) were female students. The following also presents research samples based on their school of origin.

Table 2. Distribution of Sample by School

School	MP-1		MP-2		MP-3		MP-4	
	F	%	F	%	F	%	F	%
Variable	20	24.10	20	24.10	20	24.10	23	27.70

Table 2 shows that 20 students (24.10%) were the research sample from each SMPN 1 Mataram (MP-1), SMPN 2 Mataram (MP-2), and SMPN 6 Mataram (MP-3) school, and 23 students (27.70%) were samples from SMPN 15 Mataram (MP-4) schools. Most students come from SMPN 15 Mataram.

Data Collection

Data collection on learning independence (LI) research and students' CTA in learning using MLT was carried out by conducting tests and observation sheet on students when learning using MLT. CTA was measured by giving test questions in the form of a description of 10 questions after learning using MLT, while LI was measured by making observations during the learning process using MLT, namely during four (4) meetings. The questions on the CTA questions were developed by the researcher and are already at the trial stage and it was found that the questions were valid, reliable, and the level of difficulty was difficult. Giving tests to the research sample in the form of CTA on *Zuhud and Tawakkal* material. The sub-matter of *Zuhud* studied in this study is the meaning of *Zuhud*, examples of *Zuhud* behaviour in daily life, *Zuhud* behaviour by the Prophet's companions, getting used to *Zuhud* behaviour in everyday life. In contrast, the concept of *Tawakkal* studied in this research is the notion of *Tawakkal*, examples of *Tawakkal* behaviour, and getting used to *Tawakkal* behaviour in everyday life. The following presents a grid of CTA.

Table 3. CTA Grid

No.	Critical Thinking Ability Indicator (CTAI)	Description	Item Number
1.	Elementary Clarification (CTAI-1)	1. Focusing questions 2. Analyze arguments 3. Ask and answer clarifying questions	1 and 2
2.	Basic Support (CTAI-2)	1. Consider whether the source can be trusted or not 2. Observe and consider the results of observations 3. Make deductions and consider the results of the induction	3 and 4
3.	Inference (CTAI-3)	1. Define terms and consider definitions 2. Identify assumptions	5 and 6
4.	Advanced Clarification (CTAI-4)	1. Define action 2. Interact with others	7 and 8
5.	Strategies and Tactics (CTAI-5)		9 and 10
	Total		**10**

Table 3 shows that the number of CTA questions given during the test was 10 questions. The questions on the CTA questions were developed by the researcher and are already at the trial stage and it was found that the questions were valid, reliable, and the level of difficulty was difficult. In addition to giving a written test, a observation sheet is also given in the form of a questionnaire about student learning independence. The LI observation sheet was developed by researchers and has been validated by three experts, and it was found that the LI observation sheet is valid and reliable. The following also presents a lattice of student learning independence instruments.

Table 4. Student Learning Independence Questionnaire Grid

No.	Learning Independence Indicator (LII)	Description	Item Number
1	Self-confident (LII-1)	1. Believe in your abilities 2. Do not depend on others 3. Able to solve the problem yourself	1, 2, and 3
2	Discipline (LII-2)	1. Study according to the set time 2. Prepare all learning materials neatly 3. On-time	4, 5, and 6
3	Motivation (LII-3)	1. Learn on your own 2. Have high motivation 3. Do your best in preparing for the exam	7, 8, and 9
4	Initiative (LII-4)	1. Have their learning pattern 2. Passionate about solving problems 3. Looking for other alternatives to solving the problem	10, 11, and 12
5	Responsibility (LII-5)	1. Plan your learning activities 2. Submit assigned assignments on time 3. Prepare yourself before learning begins	13, 14, and 15
	Total		15

Analyzing of Data

Research on learning independence (LI) and students' CTA in learning using MLT is quantitative research so in conducting data analysis data is used in the form of numbers that have been collected using tests and non-tests (questionnaire). The data analysis technique used to analyze the learning independence (LI) data and students' CTA is a descriptive analysis using the help of the rash model application. In mathematics, the rash model is like the following equation.

$$P_{ni}\left(x_{ni}=\frac{1}{\beta_n},\delta_i\right)=\frac{e^{(\beta_n-\delta_i)}}{1+e^{(\beta_n-\delta_i)}}$$

Where $P_{ni}\left(x_{ni}=\frac{1}{\beta_n},\delta_i\right)$ is the probability of the respondent item producing a correct answer (x=1); with the respondent's ability, β_n, and the difficulty level of the article δ_i. The above equation by Rasch can be further simplified by including the logarithmic function to obtain the following:

$$\log\big(Pni(Xni=1\ I\ \beta n,\delta i)\big)=\beta n-\delta i$$

Findings/Results

In this section, each variable is explained by taking into account gender, school origin, and indicators for each variable. Data on independent learning and students' critical thinking skills are explained as follows.

Learning Independence

Learning independence data was obtained from questionnaire filling data given to research samples. Questionnaires are given after students learn to use MLT. The indicators of learning independence used in this study are Self-confident (LII-1), Discipline (LII-2), Motivation (LII-3), Initiative (LII-4), and Responsibility (LII-5). The results of the analysis of student learning independence using the ministep software are presented in Table 5 below.

Table 5. Student Learning Independence Level

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTMEASUR-AL CORR.	PTMEASUR-AL EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	Item
13	272	75	.23	.16	.77	-1.44	.77	-1.45	.00	.28	48.0	53.0	Q13
2	274	75	.17	.17	.81	-1.17	.82	-1.08	.14	.28	57.3	54.0	Q2
8	274	75	.17	.17	1.04	.30	1.05	.32	.26	.28	46.7	54.0	Q8
4	277	75	.09	.17	1.12	.72	1.11	.71	.29	.28	54.7	54.6	Q4
7	278	75	.06	.17	.84	-.97	.84	-.92	.12	.28	60.0	55.3	Q7
6	279	75	.03	.17	.89	-.59	.90	-.57	.13	.28	52.0	55.5	Q6
12	279	75	.03	.17	.88	-.70	.88	-.71	.51	.28	58.7	55.5	Q12
9	281	75	-.02	.17	1.40	2.15	1.41	2.19	.31	.28	53.3	55.9	Q9
14	281	75	-.02	.17	1.27	1.50	1.29	1.62	.19	.28	49.3	55.9	Q14
1	283	75	-.08	.17	.87	-.74	.88	-.68	.49	.28	60.0	57.1	Q1
3	283	75	-.08	.17	.94	-.32	.93	-.36	.27	.28	57.3	57.1	Q3
5	283	75	-.08	.17	1.04	.31	1.04	.29	.45	.28	56.0	57.1	Q5
10	286	75	-.17	.17	.88	-.64	.89	-.59	.42	.27	60.0	57.8	Q10
11	286	75	-.17	.17	.90	-.55	.92	-.41	.39	.27	60.0	57.8	Q11
15	286	75	-.17	.17	1.39	2.06	1.35	1.90	.14	.27	53.3	57.8	Q15
MEAN	280.1	75.0	.00	.17	1.00	.0	1.01	.0			55.1	55.9	
P.SD	4.4	.0	.12	.00	.20	1.1	.19	1.1			4.4	1.5	

Table 5 above shows that the Q13 statement in the student learning independence questionnaire obtained the lowest score of the other statements, namely 272, with a measured value of 0.23. Q2 and Q8 obtain the same total score with a measurement value 0.17. Q4, which is a question item related to the LII-2 indicator, gets a total score of 277 with a measuring value of 0.09. Q7, which is related to the LII-3 indicator, gets a total score of 278 with a measuring value of 0.06. Q6, which relates to the LII-2 indicator, and Q12, which relates to the LII-4 indicator, obtain the same total score of 279 with a measuring value of 0.03.

Table 5 also shows that Q9 which relates to the LII-3 indicator and Q14 which relates to the LII-5 indicator obtain the same total score of 281 with a measurement value of -0.02. Q1 and A3 which relate to the LII-1 indicator and Q5 which relates to the LII-2 indicator obtain the same total score of 283 with a measuring value of -0.08. Q10 and Q11 related to the LII-4 indicator and Q15 related to the LII-5 indicator obtained the same total score of 286 with a measurement value of -0.17. The results of the analysis above show that the higher the total score and the smaller the measurement value, the better student learning independence. The following also presented pictures related to student learning independence after using MLT.

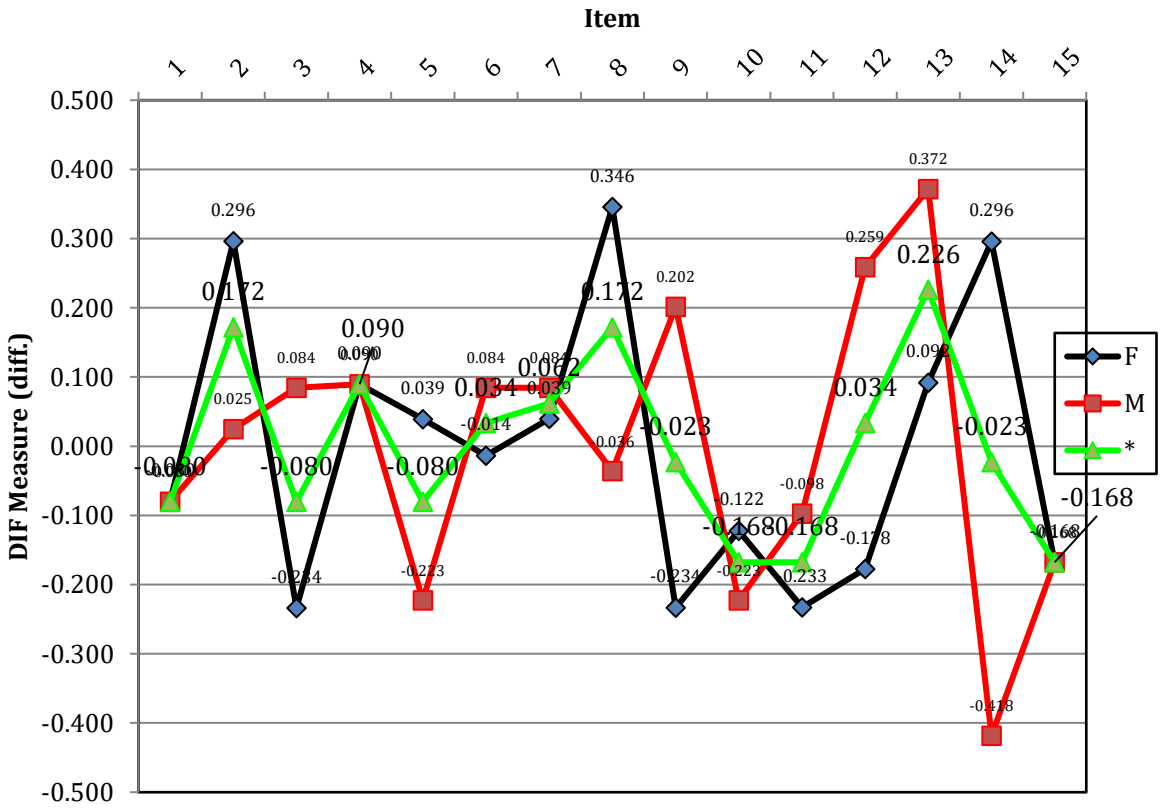

Figure 2. Student Learning Independence Based on Gender

Figure 2 shows that in the Q1 statement items related to the LII-1 indicator, male and female students obtained the same logit value of -0.08. In item Q2 which is related to the LII-1 indicator, male students obtain a small logit value of 0.025 compared to female students of 0.296 with an average logit value of 0.172. Q3 which is related to the LII-1 indicator, female students obtain a smaller logit value of -0.214 compared to male students of 0.084 with an average logit value of -0.080.

Figure 2 also shows that Q4 is related to the LII-2 indicator; male students and female students obtain the same logit value of 0.090. Q5, related to the LII-2 indicator, male students get a smaller logit value of -0.223 compared to female students of 0.039 with an average logit value of -0.080. Q6, related to the LII-2 indicator, female students get a smaller logit value of -0.04 compared to male students of 0.084 with an average logit value of -0.014. Q7 which is related to the LII-3 indicator, female students obtain a smaller logit value of 0.039 compared to male students of 0.094 with an average logit value of 0.062. Q8 which is related to the LII-3 indicator, male students obtain a smaller logit value of 0.036 compared to female students of 0.346 with an average logit value of 0.172. Q9, related to the LII-3 indicator, female students obtain a smaller logit value of -0.234 compared to male students of 0.202 with an average logit value of -0.023.

Figure 2 shows that Q10 is related to the LII-4 indicator; male students obtain a smaller logit value of -0.233 compared to female students of -0.123 with an average logit value of -0.168. Q11 which is related to the LII-4 indicator, female students obtain a smaller logit value of 0.233 compared to male students of -0.098 with an average logit value of -0.168. Q12 which is related to the LII-4 indicator, female students obtain a smaller logit value of -0.118 compared to male students of 0.259 with an average logit value of 0.034. Q13 which is related to the LII-5 indicator, female students have a smaller logit value of 0.092 compared to male students of 0.372 with an average logit value of 0.226. Q14 which is related to the LII-5 indicator, male students obtain a smaller logit value of -0.418 compared to female students of 0.296 with an average logit value of -0.023. Q15 which is related to the LII-5 indicator, male and female students obtain the same logit value of -0.168. The analysis was also carried out on a combination of two demographic data, namely data on gender and school origin, and presented students' learning independence based on this combination.

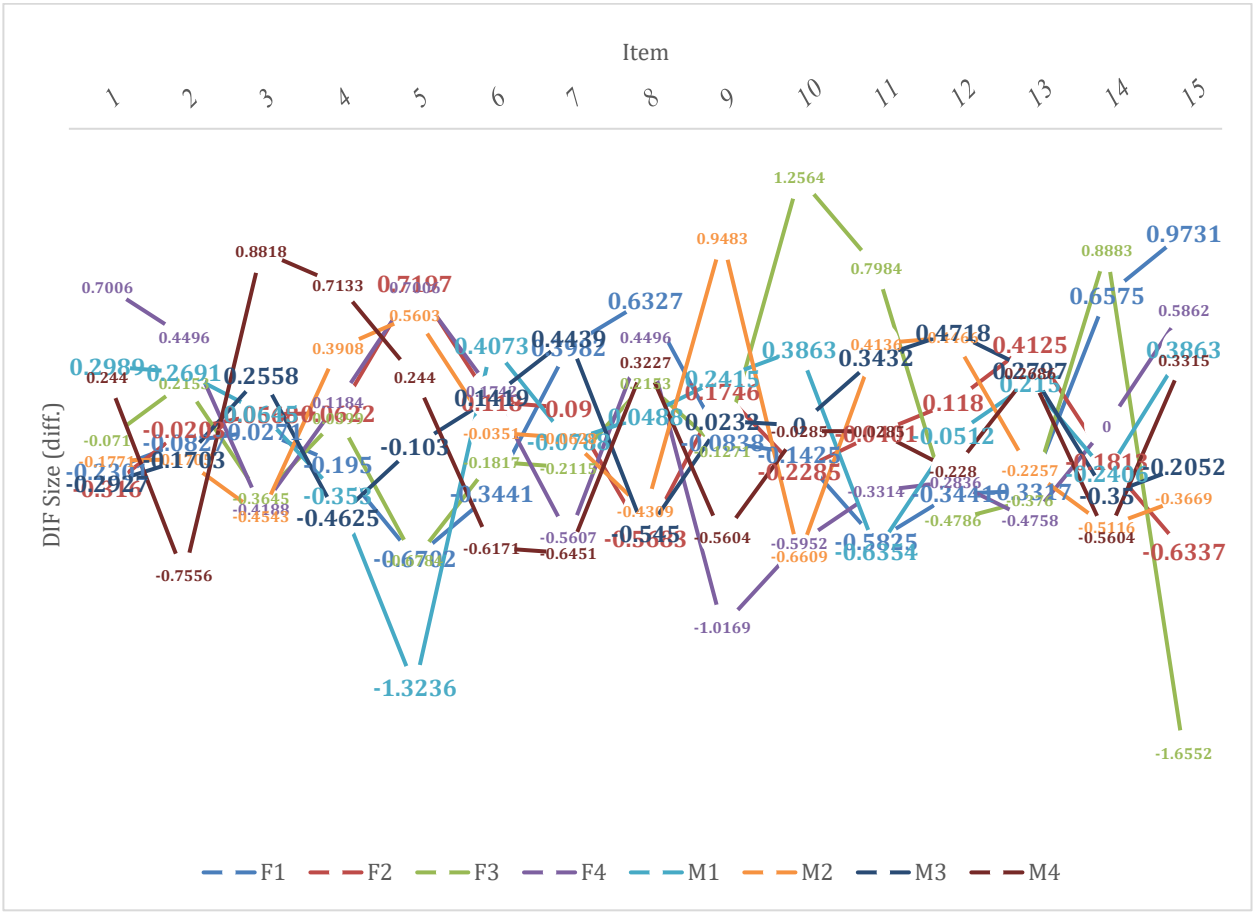

Figure 3. Student Learning Independence Based on a Combination of Gender and School Origin

Figure 3 shows that female students from MP-4 schools (code: F4) obtain a lower logit value of -0.7556 compared to the other groups on the LII-1 indicator. On the LII-2 indicator, female students from MP-1 schools (code: F1) obtained lower logit scores than the other groups on that indicator. In the LII-3 indicator, female students from MP-4 schools (code: F4) obtained a smaller logit score of -0.6451 compared to the other groups on that indicator. In the LII-4 indicator, male students from MP-2 schools (code: M2) obtained a lower logit score of -0.6609 compared to the other groups on that

indicator. In the LII-5 indicator, female students from MP-3 schools (code: F3) obtained a smaller logit score of -0.6552 compared to the other groups on that indicator.

Critical Thinking Ability (CTA)

After mastering MLT, a written test was used to collect CTA data. The indicators of CTA used are Elementary Clarification (CTAI-1), Basic Support (CTAI-2), Inference (CTAI-3), Advanced Clarification (CTAI-4), and Strategies and Tactics (CTAI-5) (Ennis, 2018). The results of the analysis of students' CTA after learning to use MLT are presented in Figure 4.

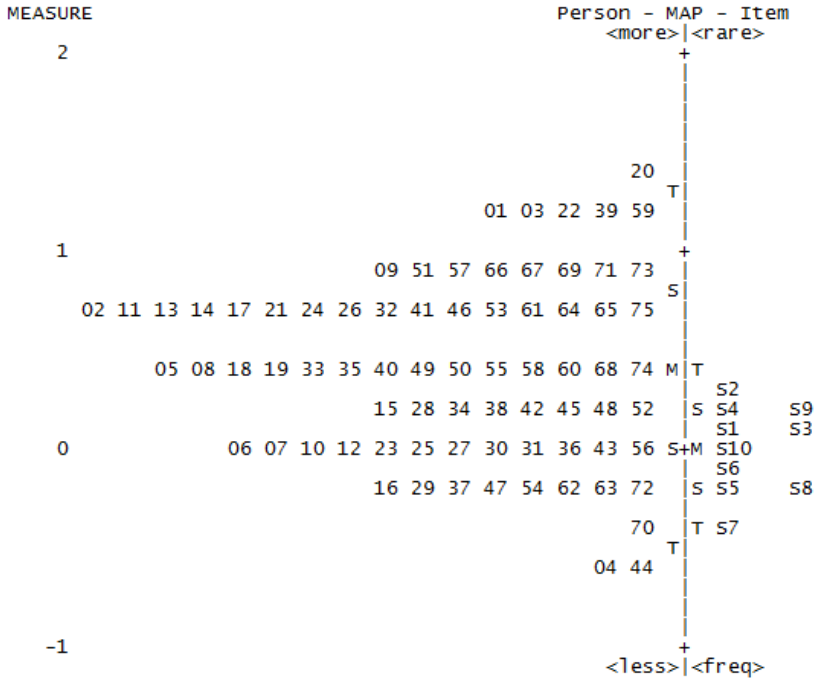

Figure 4. Distribution of Students' CTA

Figure 4 shows the distribution of students' CTA on the left and item difficulty levels on the right. On the left side of the distribution, it can be seen that 44 students have a high level of CTA. The 44 (44) students have a higher level of CTA than all the difficulty levels of the questions given. This indicates that these students get the maximum value. On the lower left of the distribution of students' CTA, three (3) students with low CTA (70, 04, and 44) are unable to work on the questions with the lowest difficulty, namely item number 7 (code: S7).

Figure 4 also shows that on the right side of the Wright map, it can be seen that the ten CTA questions have variability of varying levels of difficulty from question number 2 (code: S2), the most difficult to question number 7 (code: S7) which is the easiest to work on. This shows that the questions on CTA given to students can provide helpful information about the CTA of the students being tested. Figure 4 above also shows that the distance between the M-S-T (mean, 1SD, and 2SD) on the Wright map shows that the distribution for students' CTA (on the left) is wider than the distribution for the difficulty level of the questions (on the right). This indicates that the items on CTA given to students are not very diverse. The same is true of students' CTA, where the students' CTA of the 83 students tested was not too far away. The following also presents an analysis of students' CTA in terms of gender.

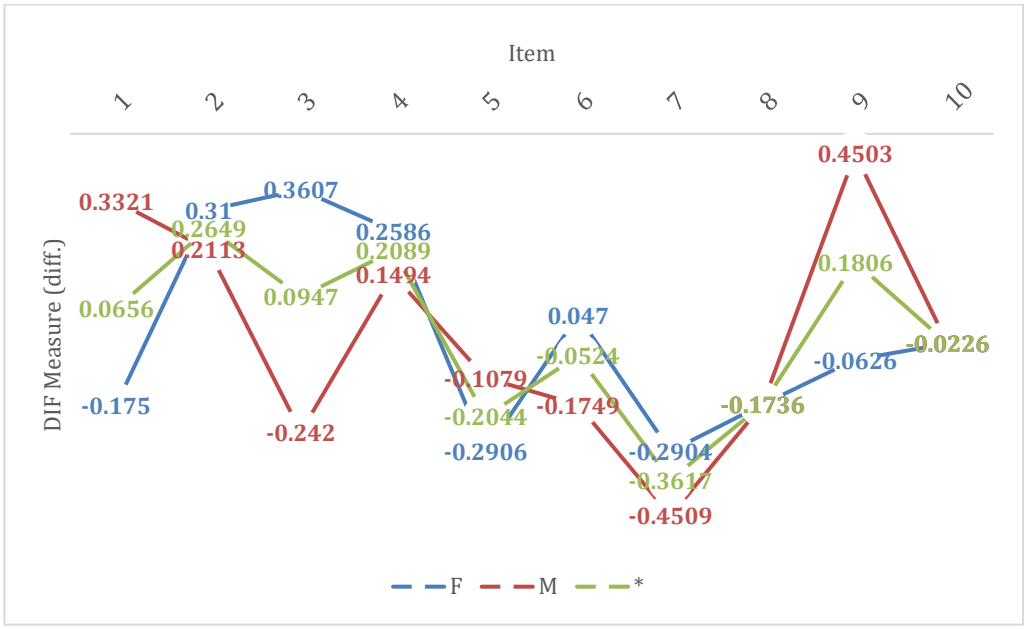

Figure 5. Students' CTA Based on Gender

Based on Figure 5, it can be seen that there are three curves, namely female students (code: F), male students (code: M), and an asterisk (code: *), which indicates the average value. Male and female students have the same critical thinking skills for item number 8 (code: S8) and item number 10 (code: S10). In Figure 5 above, it can be seen that female students have more difficulty answering question number 2 (code: S2), item number 3 (code: S3), item number 4 (code: S4), item number 6 (code: S6), and item number 7 (code: S7) compared to male students. However, for item number 1 (code: S1), item number 5 (code: S5), and item number 9 (code: S9), female students answered more quickly than male students. Male students have different characteristics from female students. The following also presents a picture of students' CTA regarding gender and school origin.

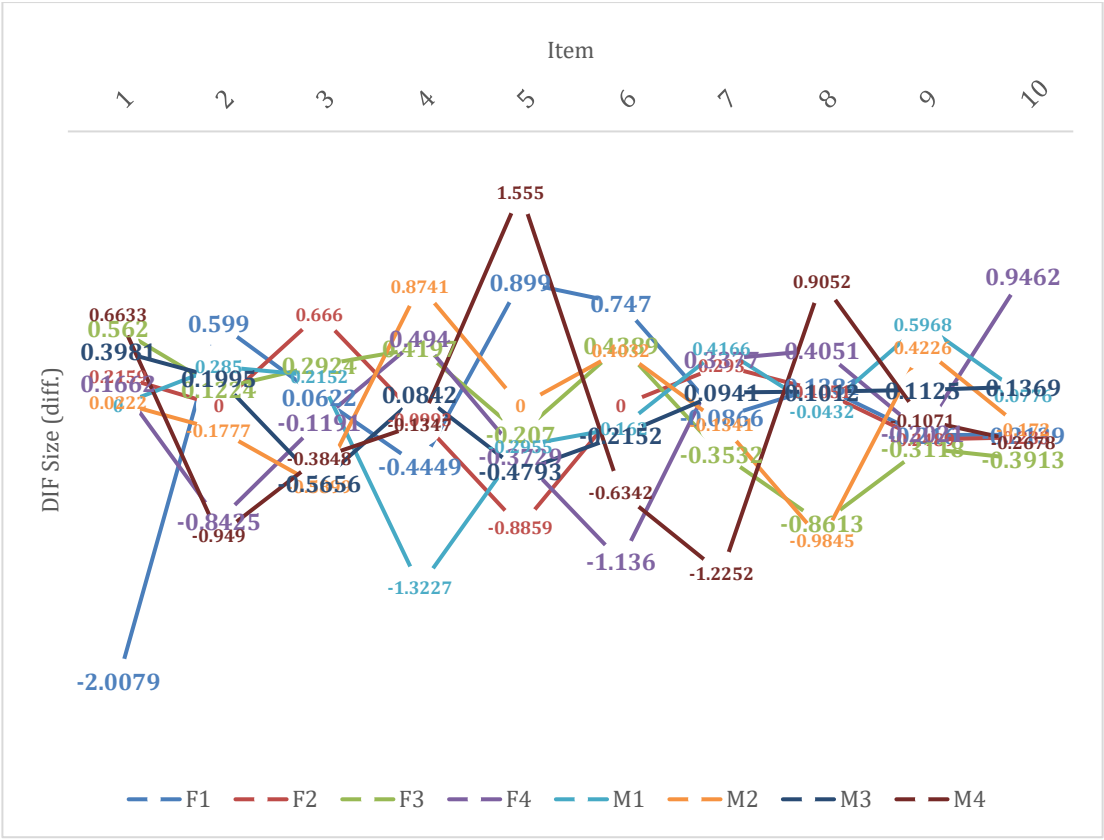

Figure 6. Students' CTA Based on a Combination of Gender and School of Origin

Based on Figure 6, it can be seen that there are eight curves, namely female students from school MP-1 (code: F1), female

students from school MP-2 (code: F2), female students from school MP-3 (code: F3), female students at school MP-4 (code: F4), male students from school MP-1 (code: M1), male students from school MP-2 (code: M2), male students from school MP-3 (code: M3), and male students from school MP-4 (code: M4). In the figure above, it can be seen that students with code M4 have lower CTA in item 1 (code: S1), item number 5 (code: S5), and item number 8 (code: S8) compared to the other groups. However, students with code M4 had better CTA in item number 2 (code: S2) and item number 7 (code: S7) compared to the other groups.

Figure 6 also shows that students' CTA with code F1 in item number 1 (S1) and item number 4 (code: S4) is better than the other groups. Students with code F2 have better CTA on item number 5 (code: S5) than the other groups. Students with code M2 have better CTA on item number 8 (code: S8) than other group students' critical thinking skills. Students with code F4 also have better CTA in item number 6 (code: S6) than other groups. The following also presents students' CTA based on indicators.

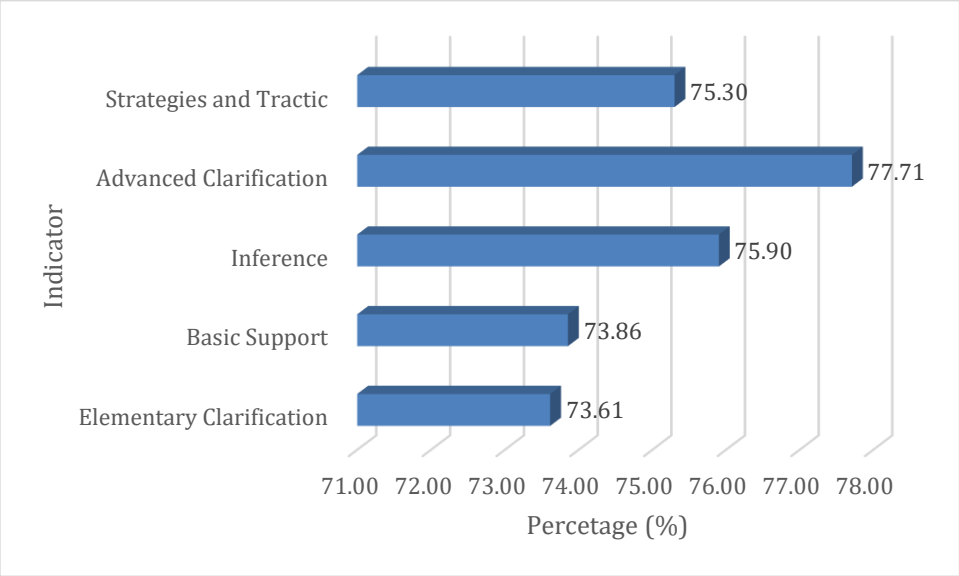

Figure 7. Students' CTA Based on Indicators

Figure 7 shows that students' CTA for each indicator has a percentage value of more than 70%. The indicator that has a higher percentage is the advanced clarification indicator (77.71%). This indicates that 77.71% of students can define terms and consider terms used in solving problems and can identify assumptions that will occur related to the solution being carried out. Figure 7 also shows that 75.90% can make deductions and consider the results of deductions, make an induction and consider the results of the induction, and make and consider value decisions. 75.30% of students can think critically about defining actions and interacting with others. 73.86% of students can think critically about whether the source can be trusted and observe and consider the results of observations. 73.61% of students can think critically by focusing on questions, analyzing arguments, and asking and answering clarifying questions.

Discussion

This study aims to determine students' independent learning (LI) and CTA in learning using MLT. This research was conducted in four junior high schools in Mataram.

Learning Independence

The analysis of student independence data shows that students have good independent learning patterns, can solve given problems, and always look for other alternatives in solving problems (Foerster et al., 2017). However, some students also seem unable to plan independent learning activities well enough. This happens because the material presented in MLT is not pleasant for some students. Using MLT directly provides opportunities for students to study independently wherever they are. In addition, teachers also do not provide opportunities for students to try to carry out MLT operations that are used in learning, so students have difficulty accessing MLT when they want to do independent learning (Gill, 2017). With the opportunities given by the teacher for independent learning, it can automatically create independent students. Previous research on the use of MLT only focused on MLT, which other studies had developed without validating it by media experts. Meanwhile, this study uses self-developed MLT and has been validated by experts for use in learning (Bai et al., 2020; Van Leeuwen & Janssen, 2019; Vitoria et al., 2018).

The study results also show that the learning independence of male and female students is not much different. On the self-confidence indicator, male and female students have the same self-confidence. In the discipline indicator, female students are better than male students. On the motivational indicator, male students have better motivation for

independent learning than female students. On the initiative indicator, female students have better initiative than male students. On the responsibility indicator, male students have better responsibility than female students. The results of research conducted by (Schlenz et al., 2020) show that in learning, in general, there is no average difference in learning independence between male and female students. Schlenz et al. (2020) research aims to assess the students' and lecturers' perspectives on implementing online learning due to COVID-19 using a questionnaire survey. In this study, the focus is more on online learning using MLT. There is no average difference in learning independence between male and female students, indicating that apart from gender, other factors influence learning independence more. Several factors that can influence learning independence have been revealed by (Mazenod et al., 2019) that influence independence, such as genes or heredity, parenting style, education system, and life at school.

Analysis of the DIF curve in Figure 3, which describes student learning independence based on a combination of gender and school origin in the four junior high schools, shows that, in general, male and female students from the four schools have pretty good learning independence. Implementing learning using MLT independently allows students to learn according to their wishes, hopes, and motivations. Students can better explore essential MLT topics, improving their learning process (Cakrawati, 2017). Students can also plan and assess their learning outcomes by filling out the quizzes in the MLT feature (Alqurashi, 2019; Kintu et al., 2017). The similarity of research conducted by Alqurashi (2019) and Kintu et al. (2017) with this research is the use of technology in learning. The difference lies in the abilities achieved in the technology-based learning process.

The principle of independent learning developed by Among shows that independent learning has a profound meaning in the educational process related to the nature of humans who are helpless at birth. However, human powerlessness is a process that leads to independence. In the among system, the relationship between educators and students is not a relationship of mutual dependence but rather a relationship that increasingly provides opportunities for students to stand alone (Bucea-Manea-Ţoniş et al., 2020).

Critical Thinking Ability

Student CTA data analysis results show that most students have high CTA, but some students also have below-average CTA. This means that these students must be guided further in learning using MLT. These students must be accustomed to using technology in learning (Ahmadi, 2018). Previous research is also about learning to use MLT; the ability to think critically stimulates cognitive reasoning in acquiring knowledge. Students' CTA is needed because, during the learning process, students develop ideas about the problems contained in learning (Mutiani et al., 2021; Perdana et al., 2019; Surya et al., 2017).

The study also showed that male and female students had different CTA. This is due to the application of MLT-based learning, which facilitates students to think more logically every time they use MLT. Male students are more dominant in the basic support and advanced clarification indicators. Meanwhile, female students were more dominant in the elementary clarification, inference, strategies, and tract indicators. This can be seen from the results of research, which show that on these indicators, female students obtain higher scores than male students. Male students have different characteristics from female students. The way of thinking of male students differs from that of female students. Their differences can be seen in their physical strength, psychosexual development, interest in different fields, perseverance, thoroughness, and tendencies to learn methods more suitable for each gender.

Analysis based on the CTA indicator shows that the advanced clarification indicator has a higher percentage than the other. Students can identify terms properly and correctly. The results of previous studies are also in line with the results of current research, which states that in the MLT used by students, information on essential terms is presented as keywords or glossaries, which can become concepts that students must understand (Daud et al., 2019; Yurdagül & Öz, 2018). With MLT, students are helped by things related to the terms of the material being taught (Cakmak, 2019; Surahman & Alfindasari, 2017). The use of MLT in learning can facilitate the teaching and learning process carried out in or outside the classroom, attract students' attention, foster enthusiasm, and motivate students in learning so that the material being delivered can be understood by students (Wenyuan, 2017).

Conclusion

The results of this study illustrate that student learning independence and students' CTA using MLT obtain high scores. Learning using MLT enables students to determine their way of learning and look for additional information in various learning resources. Male and female students from four junior high schools in Mataram have learning independence in the excellent category, namely 77.38%. Each indicator of learning independence obtains a percentage above 70%, which is in the good category. The CTA of male and female students from the four schools also obtained a percentage of 75.28% in the good category. Each indicator of CTA also obtains a percentage of more than 70%, meaning that each indicator is in a good category.

Student learning independence and critical thinking skills are two abilities that students must have in facing the challenges of 21st-century developments. This researcher contributes to MLT-based learning to improve students' necessary thinking skills and independent learning. The research that has been done can answer the gaps in the literature.

Recommendations

Based on the results of the research that has been done, there are several recommendations that I can convey: (a) for future researchers to be able to carry out further analysis related to the application of MLT-based learning to critical thinking skills with independent learning using inferential statistics, and (b) future researchers can also choose a larger sample.

Limitations

The limitations of this study are: (1) this research only includes a limited sample; therefore, it is hoped that future research can use even more samples to be able to find out more details regarding independent learning and students' critical thinking skills; (2) this research has not carried out maximal instrument trials in the field, it is just that instrument tests have been carried out by media experts, field experts, and curriculum experts. Therefore, for further research, you can use this instrument by conducting trials on students first, and (3) other research can analyze the effect of independent learning and students' critical thinking skills on MLT.

Authorship Contribution Statement

Maimun: Conceptualization, design, supervision, drafting the manuscript, critical revision of the manuscript, and final approval. Bahtiar: Data analysis, interpretation, securing funding, statistical analysis, material support, and data acquisition.

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