

Confirmatory Factor Analysis of Students' Motivation Towards Massive Open Online Course Scale

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Abstract: *The objective of this research is to use confirmatory factor analysis in the LISREL program to verify the factor structure of a collection of observed variables, eliminate a few points in assessing the irrelevant behavior factors, and confirm the data with the model fit. The study includes two sample groups. We used the original self-regulated online learning form with 42 questions in phase one. We ran a confirmatory factor analysis on the data from the group sample size of 1,999 participants on the LISREL application that generates a modified self-regulated online learning form that includes only 31 questions. In phase two, we use a modified self-regulate form as a survey and collect the data from a sample size of 10,000 participants. Model fit, and survey results were closely matched, which suggests that learners have good self-regulation for online learning.*

Keywords: Massive Open Online Course, Self-regulated Online learning, Confirmatory Factor Analysis,

1. Introduction

Since the covid-19 epidemic, several nations have switched from face-to-face classes to online classes, which has increased the popularity of online learning. Due to the rapidly growing number of users, MOOCs have developed systems and courses that cover all areas of learning (Buhl & Andreasen, 2018). More than 220 million people currently use MOOCs worldwide (Dhawal, 2021). Additionally, MOOCs provide elective courses that can be studied at any age as well as general education courses (Sillak-Riesinger, 2016). MOOC is a free online course. That opens up the opportunity for everyone to learn without limits. The meaning of MOOC comes from four total words: Massive means that the system can support the number of members and register a lot. Open means open to study freely, and any student can register for study without being a student or staff within the institution—online means using an online teaching method via the Internet. Course means a set of subjects used in Teaching and learning (Pomerol et al., 2015), consistent with Serhat Kurt (Serhat, 2018) defined the MOOC as an extensive open online course that can accommodate many learners. Students can learn asynchronously and study anywhere, anytime, on an online teaching management system that sends learning information online. Most MOOCs are open for free. Most of the learning styles are recorded video lectures reading content, online assessments, and the interaction between students and students or students and teachers. The concept of MOOC has gained popularity all over the world. Because it can change how many people can access learning content. As a result, many universities and projects have initiated their interest in the online course development project, resulting in the MOOC Platform continually occurring and the number of online courses increasing according until it was dubbed by The New York Times that 2012 is The Year of the MOOC (Laura, 2012). One of the most outstanding features of MOOCs is their ability to accommodate a large number of students, while traditional classrooms are limited in their capacity. Moreover, most of the courses are free. This helps learners outside the education system to be able to learn to increase work skills or seek knowledge in things that they like and are more

comfortable with. And able to deliver knowledge content to learners around the world through the Internet (Aljaraidh, 2019).

Since 2015, the Thai Cyber University project has been using the Thai MOOC platform for online learning. The platform has more than 1.5 million learners and over 3.8 million registrations. From the data, more than 1.5 million learners have completed the program from the total enrollment (Thai Cyber University 2023). Therefore, more than 38 percent of learners complete the course, a higher statistic than the average MOOC standard, with success rates between 7-13% only (Nesterowicz et al., 2022). One essential and decisive factor in the learning effectiveness of MOOCs is self-regulation skills in online learning. Self-regulated online learning will help learners improve their learning progress and more quickly encourage active self-learning and learning success. Therefore, self-control is one of the most essential attributes of online learning. Because of the online learning environment, many things distract students, and one of the biggest concerns in MOOCs is how to give learners self-control to complete their studies. (Liang-Yi, 2015).

Self-regulated learning contributes to the success of learners. It encourages learners to find ways to learn and adapt to the learning process until success. Studies have shown that learners with good self-regulated tend to have good grades (Ingkavara et al., 2022). In online learning, Self-control is essential because learners are free from teacher supervision. Self-regulated strategies are often used during online learning, such as learning planning—self-adjustment to study and constantly evaluate their academic achievements resulting in better online learning efficiency (Hong et al., 2021). The best strategies to acquire self-control are to set goals and create an environment that encourages learning (Salinee, 2015). One of the most crucial factors in online learning is analyzing one's areas of weakness because it helps students maintain their focus throughout the course (Leonardo, 2019). Emotional management is the second aspect to be concerned about because students can leave the course whenever they want. They must maintain their attention even when their surroundings encourage them to give up and quit (Jansen et al., 2017). Jansen and a colleague created the self-regulated online learning questionnaire form, divided into five main components, which are widely used worldwide and used as a tool for collecting the data. With the different environments, a few characteristics should not be used in Thai MOOC; researchers must eliminate these points to make the system most beneficial for users. The confirmatory factor analysis is one of the finest models for verifying the factors structure of a collection of the observed variable since it allows the researcher to assess whether there is a relationship between observable variables and underlying latent constructs. It also helps researchers to eliminate unrelated variables. (Timothy, 2020).

2. Purpose of research

2.1 To use confirmatory factor analysis in the LISEL program to verify the factors structure of a collection of observed variables

2.2 To exclude variables that unrelated to Model Fit

3. Method

3.1 Process and Data Collection

This quantitative research is from Thailand's Massive Open Online Course (Thai MOOC), which has over 501,925 users who have achieved certification. The study is divided into two phases. In the first phase, the researcher uses the original Self-regulated Online Learning Questionnaire, which contains 42 questions organized into five sections: learning motivation, time management, environmental structuring, persistence, and help-seeking. For each measurement segment, the analyst calculates the mean and standard deviation. The following tools are used by the researcher: A-priori Sample Size Calculator for Structural Equation Models. The variable is assigned following this: The effect size expected is 0.1, the number of latent variables is 7, the number of observable variables is 42, and the probability level is 0.05. The minimal sample size required to detect an impact is 1808 participants, yet this study has 1,999 participants. The researcher next analyzes the data using confirmatory factor analysis in LISREL to exclude irrelevant factors.

In the second phase, the researchers collect data from a specific demographic from the Thai MOOC using the modified self-regulated Online Learning Questionnaire, which contains 31 questions. The data was collected during the last module of the online lesson. It ran from June 14 to July 12, 2020, and received 10,737 questionnaire responses. However, only 10,000 data were used.

3.2 Analysis

In phase one, the researcher used The Original Self-Regulated Online Learning Questionnaire, which is divided into seven levels. A total of 1,999 participants were included in the study. The researcher ran a confirmatory factor analysis in the LISREL program. The Model fit and Chi-Square were used in the models to find Pearson's Correlation

Coefficient. According to the results, the variables are the spread of a normal distribution. Pearson's Correlation Coefficients are both less than 0.8, showing that the model fits well and won't cause multicollinearity (when R-value exceeds 0.8). The 160 people who applied are now eligible for the next stage. In LISREL version 8.72, the secondary Confirmatory Factor Analysis is used to calculate variance for creating Covariance Matrix. The variance was used to test hypotheses derived from both data and interviews to see if they were connected to Model Fit. According to the following variables, the hypothesis is unrelated to model fit: RMSEA = 0.063, RMR = 0.12, SRMR = 0.56, CFI = 0.99, GFI = 0.86, AGFI = 0.84, CN = 295.79, Chi-Square = 6549.85, df = 732, p-value = 0.00000, Chi-Square/df = 894, RMSEA = 0.063, RMR = 0.12, SRMR = 0.56, CFI = 0.99. The researchers cannot accept the Factor Loading Score when the hypothesis does not correspond with Model Fit; thus, they generate an Adjust Model.

The following data has been adjusted by the researcher to fit the model.

1. Remove 11 error variance variables from the hypothesis, as well as any variable with a Factor Loading score of less than 0.4.
2. Allow 21 correlated pairs of Error variance in the hypothesis.

The Adjust Model now corresponds to the Model fit by the following variable, as seen in the result: Chi-Square = 1880.56, df = 406, p-value = .00000, Chi-Square/df = 4.63; RMSEA = .043 RMR = .10; SRMR = .044; CFI = 1.00; GFI = .94; AGFI = .93; CN = 520.52 The estimated parameter value is shown in the tables below.

Table 1. The adjusted Self-regulated Learning Questionnaire (SOLQ) (N=1999), confirmatory factor analysis was performed.

Variable	Self-regulated Learning Questionnaire (SOLQ)	Factor Loading (l)	Error (q)	t	R ²
1 Metacognitive learning: ML ($\rho_c = .95, \rho_v = .87$)		.97	.44	13.01	.94
1.1 Metacognitive activities before learning: BL ($\rho_c = .92, \rho_v = .70$)		.94	.28	13.37	.88
BL01		.75	.44	-	.56
BL04		.85	.28	39.43	.72
BL05		.86	.26	40.04	.74
BL06		.87	.25	40.19	.75
BL07		.86	.26	40.00	.74
1.2 Metacognitive activities during learning: DL ($\rho_c = .91, \rho_v = .67$)		.97	.05	13.68	.97
DL03		.85	.28	-	.72
DL04		.83	.31	46.91	.69
DL05		.84	.30	47.48	.70
DL06		.77	.41	41.37	.59
DL07		.84	.30	47.30	.70
1.3 Metacognitive activities after learning: AL ($\rho_c = .94, \rho_v = .74$)		.96	.07	13.67	.93
AL02		.85	.27	-	.73
AL03		.85	.28	49.61	.72
AL04		.89	.20	54.79	.80
AL05		.85	.28	49.78	.72
AL06		.88	.23	53.14	.77
2 Time management: TM ($\rho_c = .86, \rho_v = .61$)		.96	.07	44.15	.93
TM01		.85	.28	-	.72
TM02		.53	.72	23.40	.28
TM03		.84	.29	47.62	.71
TM05		.86	.27	48.85	.73

Variable	Self-regulated Learning Questionnaire (SOLQ)	Factor Loading (l)	Error (q)	t	R ²
3 Environmental structuring: ES ($\rho_c = 91, \rho_v = 76$)		.85	.27	38.65	.73
ES02		.86	.26	-	.74
ES03		.91	.18	54.11	.82
ES04		.85	.27	49.13	.73
4 Persistence: PE ($\rho_c = 88, \rho_v = 65$)		.74	.46	30.95	.54
PE03		.83	.31	-	.69
PE04		.82	.32	36.73	.68
PE05		.75	.43	32.46	.57
PE06		.83	.31	37.18	.69
5 Help seeking: HS ($\rho_c = 93, \rho_v = 73$)		.66	.56	28.13	.44
HS01		.83	.32	-	.68
HS03		.86	.26	49.56	.74
HS04		.87	.24	46.38	.76
HS05		.88	.22	53.22	0.78
HS06		.85	.29	44.46	0.71

Chi-Square = 1833.62 df = 405 p-value = .00000, Chi-Square / df = 4.52;

RMSEA = .042 RMR = .047 ;SRMR = .043; CFI= 1.00; GFI = .94; AGFI = .93; CN = 536.76

Result:

The five components of SOLQ have the standard solution ranges from 0.06 to 0.97 at the 0.05 level of confidence (the t-test ranges from 13.01 to 44.15), and the standard error of the mean ranges from 0.07 to 0.56. With these values, we can estimate the variance of reliability. Considering the use of R2, the reliability of SOLQ ranges from 44 to 94 percent.

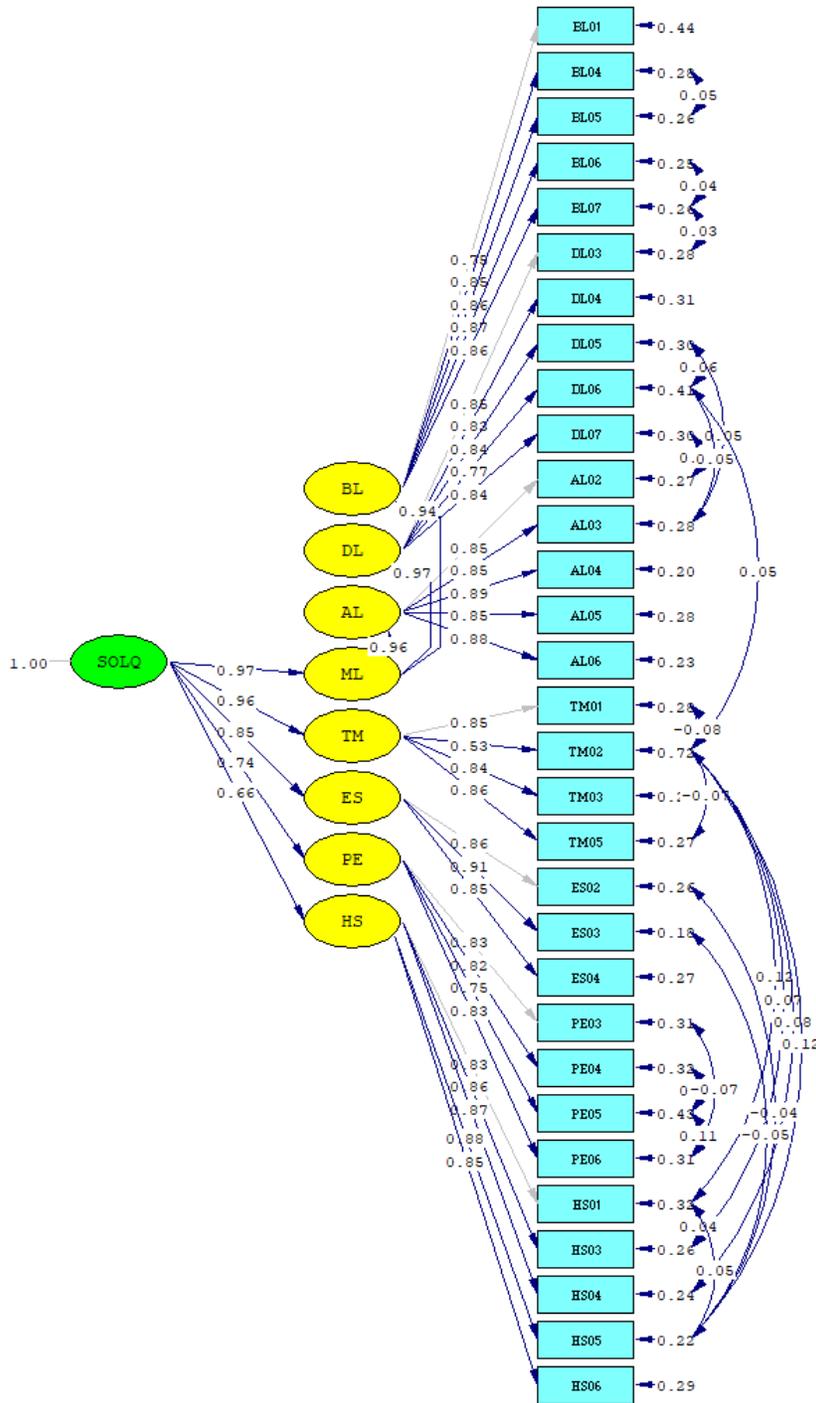
The first component is learning motivation which is divided into three parts: before learning, during learning, and after learning. The average standard solution ranges from 0.85 to 0.94 at the 0.05 confidence level (the t-test ranges from 13.37 to 13.68), and the average standard error of the mean ranges from 0.05 to 0.28. With these values, we can estimate the variance of learning motivation. Considering the use of R2, the average reliability of SOLQ ranges from 73 to 96 percent. Before learning is the first part and has five parts: BL01, BL04, BL05, BL06, and BL07, which have the standard solution ranges from 0.75 to 0.86 at the 0.05 confidence level (the t-test ranges from 39.43 to 40.19) and the standard error of the mean ranges from 0.25 to 0.44. With these values, we can estimate the variance of learning motivation. Considering the use of R2, the reliability of SOLQ ranges from 56 to 75 percent. The second part is during learning which has five parts: DL03, DL04, DL05, DL06, and DL07, which have the standard solution ranges from 0.77 to 0.96 at the 0.05 confidence level (the t-test ranges from 13.67 to 48.48) and the standard error of the mean ranges from 0.25 to 0.44. With these values, we can estimate the variance of time management. Considering the use of R2, the reliability of SOLQ ranges from 59 to 72 percent. The last part is after learning, which also has five parts: AL02, AL03, AL04, AL05, and AL06, which have the standard solution ranges from 0.85 to 0.89 at the 0.05 confidence level (the t-test ranges from 49.61 to 54.7) and the standard error of the mean ranges from 0.20 to 0.28. With these values, we can estimate the variance of time management. Considering the use of R2, the reliability of SOLQ ranges from 72 to 80 percent.

The second part is time management which has four parts: TM01, TM02m TM03, and TM05, which have the standard solution ranges from 0.53 to 0.86 at the 0.05 confidence level (the t-test ranges from 23.4 to 48.85) and the standard error of the mean ranges from 0.20 to 0.28. With these values, we can estimate the variance of time management. Considering the use of R2, the reliability of SOLQ ranges from 23 to 73 percent.

The third part is environmental structuring which has three components: ES02, ES03, and ES04, which have the standard solution ranges from 0.85 to 0.91 at the 0.05 confidence level (the t-test ranges from 23.4 to 48.85) and the standard error of the mean ranges from 0.18 to 0.27. With these values, we can estimate the variance of environmental structuring. Considering the use of R2, the reliability of SOLQ ranges from 73 to 82 percent.

The fourth part is persistence which has four parts: PE03, PE04, PE05, and PE06, which have the standard solution ranges from 0.75 to 0.83 at the 0.05 confidence level (the t-test ranges from 32.46 to 37.18) and the standard error of the mean ranges from 0.31 to 0.43. With these values, we can estimate the variance of time management. Considering the use of R2, the reliability of SOLQ ranges from 73 to 82 percent.

The last component is help-seeking, which has five parts: HS01, HS03, HS04, HS05, and HS06, which have the standard solution ranges from 0.83 to 0.88 at the 0.05 confidence level (the t-test ranges from 44.46 to 53.22) and the standard error of the mean ranges from 0.22 to 0.32. With these values, we can estimate the variance of help-seeking. Considering the use of R2, the reliability of SOLQ ranges from 73 to 82 percent.



Chi-Square=1833.62, df=405, P-value=0.00000, RMSEA=0.042

Figure 1. Print out adjust model

Phase 2: The collected data from a specific demographic from the Thai MOOC using the modified self-regulated Online Learning Questionnaire containing 31 questions developed by Jansen (Jansen et al., 2017). The data was gathered during the last module, which ran from June 14 to July 12, 2020, and had a total of 10,737 applications. However, only 10,000 were used. Metacognitive, Time Management, Environmental structuring, Persistence, and Help-seeking are the five sections. However, Metacognitive is divided into three periods: Metacognitive activities before learning, Metacognitive activities during learning, and Metacognitive activities after learning.

1. Metacognitive

Table 2. The modified self-regulated Online Learning Questionnaire

No.	Self-regulated Learning Questionnaire	\bar{x}	S.D.
1.1 Metacognitive activities before learning			
BL1	I think about what I really need to learn before I begin a task in this online course.	5.66	1.23
BL4	I set goals to help me manage my studying time for this online course.	5.60	1.21
BL5	I set specific goals before I begin a task in this online course.	5.59	1.20
BL6	I think of alternative ways to solve a problem and choose the best one in this online course.	5.61	1.17
BL7	At the start of a task, I think about the study strategies I will use.	5.65	1.19
		5.62	1.20
1.2 Metacognitive activities during learning			
DL3	I am aware of what strategies I use when I study for this online course.	5.56	1.17
DL4	I change strategies when I do not make progress while learning for this online course.	5.52	1.22
DL5	I periodically review to help me understand important relationships in this online course.	5.53	1.22
DL6	I find myself pausing regularly to check my comprehension of this online course.	5.42	1.30
DL7	I ask myself questions about how well I am doing while learning something in this online course.	5.59	1.20
		5.52	1.22
1.3 Metacognitive activities after learning			
AL2	I ask myself how well I accomplished my goals once I'm finished working on this online course.	5.69	1.15
AL3	After studying for this online course, I reflect on what I have learned.	5.56	1.20
AL4	I find myself analyzing the usefulness of strategies after I studied for this online course.	5.62	1.16

AL5	I ask myself if there were other ways to do things after I finish learning for this online course.	5.64	1.17
AL6	After learning for this online course, I think about study strategies I used.	5.65	1.17
		5.63	1.17

2. Time management

No.	Self-regulated Learning Questionnaire	\bar{x}	S.D.
TM1	I make good use of my study time for this online course.	5.68	1.19
TM2	I find it hard to stick to a study schedule for this online course.	5.10	1.56
TM3	I make sure I keep up with the weekly readings and assignments for this online course.	5.50	1.24
TM5	I allocate studying time for this online course.	5.57	1.21
		5.46	1.30

3. Environmental structuring

No.	Self-regulated Learning Questionnaire	\bar{x}	S.D.
ES02	I find a comfortable place to study for this online course.	5.72	1.19
ES03	I know where I can study most efficiently for this online course.	5.75	1.18
ES04	I have a regular place set aside for studying in this online course.	5.64	1.26
		5.70	1.21

4. Persistence

No.	Self-regulated Learning Questionnaire	\bar{x}	S.D.
PE03	When I begin to lose interest for this online course, I push myself even further.	5.28	1.48
PE04	I work hard to do well in this online course even if I don't like what I have to do.	5.25	1.47
PE05	Even when materials in this online course are dull and uninteresting, I manage to keep working until I finish.	5.28	1.50
PE06	Even when I feel lazy or bored when I study for this online course, I finish what I planned to do.	5.46	1.40
		5.32	1.46

5. Help seeking

No.	Self-regulated Learning Questionnaire	\bar{x}	S.D.
HS01	When I do not fully understand something, I ask other course members in this online course for ideas.	5.08	1.65
HS03	I am persistent in getting help from the instructor of this online course.	5.15	1.55

HS04	When I am not sure about some material in this online course, I check with other people.	5.06	1.60
HS05	I communicate with my classmates to find out how I am doing in this online course.	4.94	1.69
HS06	When I have trouble learning, I ask for help.	5.18	1.56
		5.08	1.61

The online course is free and open for everyone, but the primary factor to be successful in an online class is learning motivation. Participants have a chance to look at the course detail before they decide to take a course. The result from a specific demographic from the Thai MOOC using the modified self-regulated Online Learning Questionnaire are divided into seven parts is follows:

Users exhibit deep learning motivation because they set short-term and long-term goals before attending any class, as evidenced by the pre-learning average outcome of 5.62. The average score of 5.52 during learning suggests that course lessons influence learners' ability to absorb details. Participants can pause the video throughout the lecture if they are having trouble understanding the topic so they can go over it again before moving on to the next chapter. The average after-learning score of 5.63 indicates that the teaching method attracted the participants' interest. Learners review the class material and practice test questions throughout the weekend after the lecture.

Another critical aspect of success is discipline, which is separated into three parts: time management, environmental structuring, and persistence. The online course does not require schedules or locations, whereas the face-to-face session must. Some participants are not full-time students, so they must balance jobs, lectures, and extracurricular activities. The data demonstrates that successful students have a 5.46 average time management score. Participants in an online course can attend lessons from anywhere on the globe, but the learning environment has an impact on learning potential. Environmental structuring receives the highest average score of 5.7, implying that students should seek out a quiet spot to study, such as a local library or a private room. Because there is no compulsion to keep learners immobile in front of the computer screen during the lesson, self-control is essential. Learning online needs more self-discipline during the lecture, as seen by the average persistence score of 5.32.

Learning online is one-way communication. Thus there may be some difficulty in understanding material and technological issues during the course. The participants must communicate with classmates and technical support to overcome their challenges. Learning online courses provides participants with high problem-solving skills, as evidenced by their average help-seeking score of 5.08.

4. Discussions and Conclusion

The purpose of this study is to improve Thailand Massive Open Online Course: Thai MOOC by using a Self-Regulated Online Learning Questionnaire to make it more advantageous to all users. Online learning can become a mechanism that instructional design can rely on. to achieve positive learning outcomes Hence self-control in online learning. It can be a tool to enhance learning outcomes for online teaching and learning management (Chaker, 2021). To complete the Self-Regulated Online Learning Questionnaire can be used effectively in culturally diverse areas, validation and suitability are of paramount importance (Zalli et al., 2020). In this study, Eleven error variance variables were removed from the hypothesis using confirmatory factor analysis as they are unrelated. The adjusted model now only provides 31 questions, but the result is essentially unchanged. The result: Chi-Square = 1880.56, df = .406 p-value = .00000, Chi-Square / df = 4.63; RMSEA = .043 RMR = .10; SRMR = .044; CFI= 1.00; GFI = .94; AGFI = .93; CN = 520.52. Participants who earned the certification demonstrated high motivation, time management, and discipline. Include problem-solving activities throughout the course because they may encounter technical or course-related issues. The questionnaire, through confirmation factor analysis, can be used to collect self-regulation data of learners on Thailand Massive Open Online Course (Thai MOOC) to bring the results to improve the online course to suit learners in the future.

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