

The study of learning achievement and satisfaction on python programming language using STAD Cooperative Learning Technique for grade 8 students

Qiu Hua Chen,¹ Tidarat Samanpan²

Abstract

The purposes of this research were to (1) compare the post-test score and pre-test score and compare the post-test scores with 75 percentage criteria of full scores. (2) study the students' satisfaction on Python Programming Language by using STAD cooperative learning techniques. This research design was one-group pre-test and post-test design. The samples were 30 students in 8th grade students of Honggui Middle School which obtains by cluster random sampling.

The research instruments consist of (1) learning management plan based on STAD cooperative learning techniques (2) Python Programming Language course test which contains 30 single-choice questions and (3) Satisfaction Questionnaire, it is 15 items rating scale. The data were analyzed using percentage, mean, standard deviation and t-test

The results were as follow: (1) The post-test score was higher than the pre-test score on Python Programming Language by using STAD cooperative learning techniques with statistically significant at the 0.01 level and the post-test higher than 75 percentage of full score criterion with statistically significant. (2) The students' satisfaction on Python Programming Language by using STAD cooperative learning techniques is at the highest level. The mean was 4.82 and standard deviation was 0.47.

Keywords: Learning Achievement, Satisfaction, STAD Cooperative Learning Technique

¹A master degree student in curriculum and instruction, Faculty of education, Nakhonratchasima College
E-Mail: Tony <1226822551@qq.com>

²A lecturer in curriculum and instruction, Faculty of education, Nakhonratchasima College

Introduction

The promulgation of the Compulsory Education Information Technology Curriculum Standards (2022 Edition) has raised higher requirements for the cultivation of information literacy among primary and secondary school students in China. Consequently, computational thinking has become one of the most important components of core literacy in information technology education (Ministry of Education of the People's Republic of China [MOE], 2022). As one of the core elements of computational thinking, computing concepts have received increasing attention from front-line information technology educators. To promote students' understanding of computing concepts and effectively improve their computational thinking abilities, Python programming courses have been introduced into primary and secondary school curricula. Previous studies have indicated that programming education, particularly Python programming, plays a positive role in developing students' computational thinking, problem-solving skills, and logical reasoning abilities (Grover & Pea, 2013; Wing, 2006; Yadav et al., 2014). Therefore, creating an appropriate learning environment for students to understand computing concepts has become an important issue in information technology education.

The overall goals of Python programming courses in information technology education include four aspects. First, students are expected to establish correct values, develop information awareness, recognize the role and value of data in social development, evaluate information critically, and form responsible information values. Second, students should be able to define and analyze problems, organize data, formulate solutions, reflect upon and optimize solutions, and apply algorithms to solve problems using computers. Third, students are expected to improve their digital collaboration and inquiry abilities, demonstrate innovative thinking, and work collaboratively to solve learning tasks through digital technologies. Finally, students should understand and comply with the laws and regulations of the information society and fulfill their responsibilities as digital citizens (MOE, 2022). These goals emphasize that students should develop confidence and interest in learning Python programming, actively participate in group activities, collaborate with peers, and seek assistance when encountering learning difficulties.

The researchers at Honggui Middle School observed during their teaching practice that students demonstrated varying levels of achievement in Python programming courses despite receiving the same instruction within limited classroom time. Some students mastered the content effectively, whereas others experienced difficulties understanding and applying the knowledge. One possible reason is that teachers often have limited involvement in facilitating communication, discussion, and collaborative learning among students. As a result, students' learning interest, attitudes, and academic performance may not reach satisfactory levels. Traditional teacher-centered instruction tends to emphasize one-way knowledge transmission, providing learners with few opportunities to interact with peers and construct knowledge collaboratively. Moreover, teachers may overlook important elements such as appropriate group formation, student recognition and evaluation, and the development of cooperative learning skills. Consequently, students often remain passive recipients of knowledge, making it difficult to actively engage in learning activities and develop meaningful understanding, ultimately affecting learning outcomes (Johnson & Johnson, 2009; Slavin, 2015).

The Student Teams Achievement Divisions (STAD) cooperative learning model is regarded as one of the earliest, simplest, and most widely applied cooperative learning strategies (Slavin, 2015). In the STAD model, students with different achievement levels are organized into heterogeneous groups and work together to achieve learning goals. Through group discussions, peer support, and collaborative problem-solving activities, students are encouraged to understand and internalize course content. After group learning activities, individual assessments are conducted, and both individual improvement scores and team scores are calculated. Outstanding groups are then recognized and rewarded. This approach emphasizes students' academic progress and self-improvement rather than merely comparing performance among students. Research has shown that STAD can effectively enhance academic achievement, learning motivation, interpersonal relationships, self-confidence, and cooperative skills (Gillies, 2016; Slavin, 2015). Therefore, applying the STAD cooperative learning model to Python programming instruction may provide an effective approach to improving students' learning achievement and engagement.

Research objectives

1. To compare the post-test score and pre-test score and compare the post-test scores with 75 percentage criteria of full scores.
2. To study the students' satisfaction on Python Programming Language by using STAD cooperative learning techniques.

Research hypothesis

1. The post-test score was higher than the post-test score on Python Programming Language by using STAD cooperative learning techniques and The post-test higher than 75 percentage of full score criterion.
2. students' satisfaction on Python Programming Language by using STAD cooperative learning techniques is at high level.

Literature review

The study of learning achievement and students' satisfaction on Python programming Language knowledge learning using STAD for 8th grade students at Honggui Middle school, the researcher studied the relevant literature as follows:

1. Formulated by the Ministry of Education of the People's Republic of China, "Compulsory Education Information Technology Curriculum Standards" (2022 edition)
2. Relevant documents of Python Programming Language
3. The STAD Cooperative Learning Techniques
4. Learning Achievement
5. Satisfaction
6. Related Research

Conceptual framework

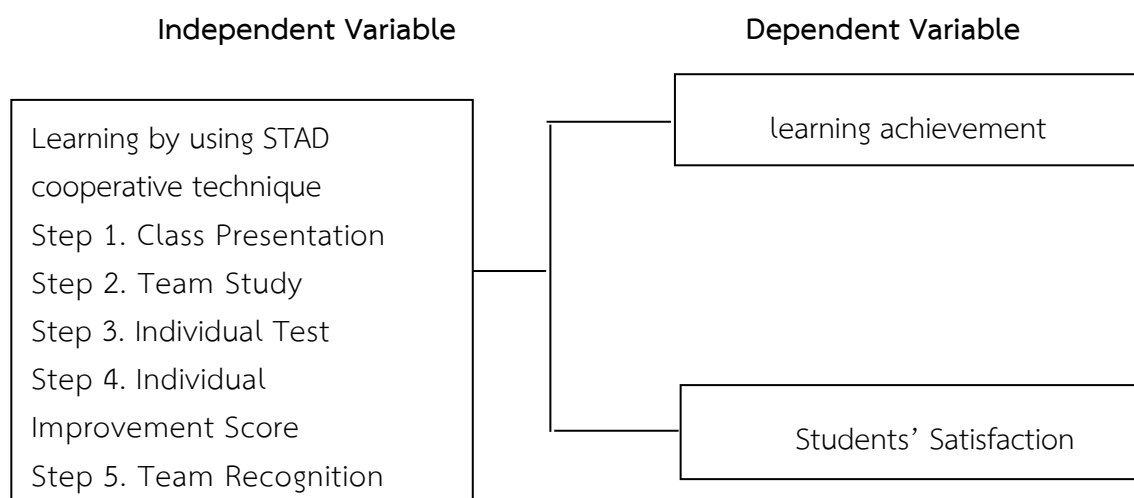


Figure 1 Conceptual Framework

Methodology

1. Research method

This research was Pre-experimented Design The one-group pre-test and post-test design (Cambell and Stanley, 1969) was used in this study.

Table 3.1 The one-group pre-test and post-test design

Group	Pretest	Treatment	Post-test
Experimental group	T1	X	T2

symbols used in the experiment:

T1 means pre-study test

X means STAD cooperative learning technique

T2 means the test after class

2. Population and sample

2.1 The research population

The population group is the students of Class 1 and 2 of 8th grade students in the fall semester of 2024 at Honggui Middle School. There are 60 students in total

and 30 in each of the two classes.

2.2 The research Samples

The samples of the study are 30 students, which obtains by cluster random sampling. The research samples was adopted to investigate 30 students from Class 1 major in 8th grade students in the fall semester of 2024 at Honggui Middle School.

3. Research instruments

The instruments used in this study consist of two parts. The course plans and tools for gathering information are as follows:

3.1 The course plan is based on the syllabus. This study chose Python Programming Language course total 5 plans, total 7.5 hours, each plan have 4 components: learning objectives, contents, learning activities and learning materials. The results of the expert review found that the learning management plan was checked using a 5-level rating scale, resulting in an average quality score of 4.90 and a standard deviation of 0.06.

3.2 instruments used for data collection consist of

1) About Python Programming Language course test. The test paper contains 30 single-choice questions, with 1 point for each question and a total score of 30 points. a test time of 45 minutes. The scores of each question are + 1, 0 and - 1. The specific meanings of different scores are shown in table 3.3. Record the scoring results of each expert on each topic, and apply IOC to measure each topic. The IOC values ranged from 0.50 to 1.00, and the reliability coefficient was 0.72.

2) Satisfaction Questionnaire, it is 15 items rating scale questionnaires. which is a rating scale of 5 levels; 5, 4, 3, 2 and 1 which means the highest, high, moderate, less and the least respectively. IOC values ranged from 0.60 to 1.00, and the reliability coefficient was 0.77.

4. Data collection

For the study, the researchers conducted their own experiments and collected data during 7.5 hours (45 minutes each) in the Semester 2, Academic Year 2024, The researcher conducted the data collection with the sample group by the following:

4.1 Prepare students by providing clarifications for students to know about

the subject to be studied and the teaching methods

4.2 The students took the pre-test by using the achievement test created by the researcher, it took of 45 minutes.

4.3 The researcher conducted teaching activities with the 8th grade students of 8th grade at Honggui Middle school Semester 2, Academic Year 2024. The number of students is 30 students is the sample group. The researcher taught according to the lesson plan on programming software course by using STAD cooperative learning model. It takes 7.5 hours to study, including pre-test and post-test time.

4.4 After teaching all the lesson plans, a post-test was performed using an achievement test that was created by the researcher for a test time of 45 minutes.

4.5 The researcher conducted a scoring of the learning achievement test on the "Python programming skills knowledge learning Score Test " for 8th grade students of 8th grade at Honggui Middle school Semester 2, Academic Year 2024. as follows: (1) Correct answer is given 1 point. (2) Wrong answer or no answer or answer more than 1 option give 0 points

4.6 The researcher gathered the scores of learning achievement for data analysis.

5. The data analysis

In this research the researcher used the data collected from the tools used in the experiment, including tools used in learning Python Programming Language and tools used for data collection. The data were analyzed in the following order:

5.1 Percentage, mean, standard deviation of pre-test and post-test.

5.2 Analyzed for t (Paired Sample t-test) to compare the difference of mean of pre-test and post-test. The level of statistical significance was set at the .01 level.

5.3 An analysis of t-values (One Sample t-test) to compare the difference of the mean of learning achievement of 8th grade students of 8th grade at Honggui Middle school Semester 2, Academic Year 2024, by using STAD cooperative learning model with 75% criteria. The level of statistical significance was set at the .01 level.

Results

1. The post-test score was higher than the pre-test score on Python Programming Language by using STAD cooperative learning techniques with statistically significant at the 0.01 level and the post-test higher than 75 percentage of full score criterion with statistically significant at the 0.01 level, as shown in table 2 and table 3

Table 2 Comparison of pre-test and post-test scores of 8th grade students in the fall semester of 2024 at Honggui Middle School. using STAD in the fall semester of 2024 using STAD.

test score	n	$\bar{x}$	S.D.	df	t	p
Pre-test	30	8.1	1.3	29	20.73	0.00
Post-test	30	24.8	33.9			

** Statistical significance at the .01 level, $t(0.01; 29) = 1.32$.

Table 3 The comparison of post-test achievement and 75% criteria of full scores by using STAD for 8th grade students in the fall semester of 2024 at Honggui Middle School.

test score	n	full score	threshold score	$\bar{x}$	S.D.	(%)	t	p
post-test	30	30	22.50	24.8	3.39	82.6	9.69	.001

** Statistical significance at the .01 level, $t(0.01; 29) = 3.44$. $p < .001$

2. The students' satisfaction on Python Programming Language by using STAD cooperative learning techniques is at the highest level. The mean was 4.82 and standard deviation was 0.47, as shown in table 4

Table 4 Results of the satisfaction assessment of students on Python Programming Language knowledge learning using STAD for 8th grade students in the fall semester of 2024 at Honggui Middle School.

Article No.	List	satisfaction level		Interpret
		$\bar{x}$	S.D.	
1	Are you satisfied with the STAD cooperative learning principle formulated by the teacher?	4.83	0.46	the highest
2	Are you satisfied with the grouping method adopted by teachers to carry out STAD cooperative learning?	4.83	0.46	a lot
3	Are you satisfied with the group task set by the teacher?	4.83	0.53	the highest
4	Are you satisfied with the teacher's performance in the teaching process?	4.93	0.90	a lot
5	Are you satisfied with the teachers' handling of problems in the process of STAD cooperative learning?	4.73	0.69	the most
6	STAD method can stimulate and encourage students' learning. Are you satisfied with the learning atmosphere in class?	4.83	0.38	the highest
7	With STAD, your attitude towards learning becomes more positive.	4.77	0.50	the highest
8	Are you more satisfied with the process of implementing THE STAD method and working in groups, cooperating with classmates, discussing and solving problems?	4.77	0.57	the highest
9	Does STAD make you more satisfied with your role playing, work tasks, and personal abilities?	4.83	0.38	the highest
10	Are you satisfied that you have learned more communication skills from STAD?	4.93	0.25	the highest
11	Are you satisfied with your full participation in the learning activities of STAD?	4.80	0.55	The highest

Table 4 Cons.

Article No.	List	satisfaction level		Interpret
		$\bar{x}$	S.D.	
12	Compared with traditional teaching, do you think STAD method is lively and interesting, and make you feel satisfied?	4.67	0.66	the highest
13	Do you have more courage to communicate with your classmates or answer your teacher's questions when implementing STAD method?	4.93	0.25	the highest
14	Do you think you are suitable for STAD?	4.90	0.40	the highest
15	Do you prefer and satisfied with teachers using STAD method in class?	4.70	0.70	the highest
Total		4.82	0.47	the highest

Discussion and conclusions

From the research on the study of the learning achievement and students' satisfaction on Python Programming Language knowledge learning using STAD for 8th grade students in the fall semester of 2024 at Honggui Middle School, the researcher discussed the results as follows:

The post-test learning achievement on Python Programming Language knowledge learning using STAD of 8th grade students was higher than pretest learning achievement with statistically significant at the level of 0.01 and above the threshold of 75 percent. Because the lesson plan or teaching activities were using STAD for 8th grade students in the fall semester of 2024 at Honggui Middle School, it was effective in improving student achievements, and encourage students to perform activities on their own and more interested in learning.

An additional implication of the findings concerns the development of students' computational thinking skills. Although the present study primarily focused on learning achievement, social skills, and satisfaction, the significant improvement in students' Python programming performance suggests that the STAD cooperative learning technique may also contribute to the enhancement of computational thinking abilities.

Computational thinking refers to the cognitive processes involved in problem decomposition, pattern recognition, abstraction, algorithm design, and systematic problem-solving (Wing, 2006). These skills are considered fundamental competencies for learners in the digital age and are emphasized in contemporary information technology education (Ministry of Education of the People's Republic of China, 2022).

The learning activities designed under the STAD cooperative learning framework required students to discuss programming problems, analyze coding procedures, identify errors, and collaboratively develop solutions. Such activities encouraged students to engage in logical reasoning and algorithmic thinking while exchanging ideas with peers. According to Grover and Pea (2013), programming instruction provides an effective context for developing computational thinking because learners are required to apply analytical and problem-solving processes to construct computer programs. Similarly, Shute et al. (2017) argued that computational thinking develops most effectively when students actively participate in authentic problem-solving situations and collaborative learning environments.

Furthermore, the collaborative nature of STAD may have strengthened students' understanding of programming concepts through peer explanation and knowledge sharing. When students explain coding procedures to their teammates, they are required to organize their thoughts, clarify concepts, and justify their reasoning. This process promotes deeper cognitive processing and supports the development of higher-order thinking skills (Johnson & Johnson, 2009). Consequently, students not only improve their academic achievement but also develop the analytical and problem-solving competencies that form the foundation of computational thinking.

These findings are consistent with previous studies indicating that collaborative programming activities can positively influence computational thinking development. Tikva and Tambouris (2021) reported that programming-based learning environments combined with collaborative instructional strategies significantly enhanced students' computational thinking skills in K–12 education. Likewise, Yadav et al. (2017) emphasized that computational thinking is most effectively developed when learners engage in active problem-solving, peer interaction, and collaborative knowledge construction. Therefore, the significant improvement in learning achievement observed in the present study may

also reflect the development of computational thinking competencies fostered through STAD cooperative learning activities.

Taken together, the findings suggest that the STAD cooperative learning technique not only improves students' achievement in Python Programming Language learning but also provides a supportive learning environment that promotes computational thinking, collaborative problem-solving, and active engagement in learning. These outcomes are closely aligned with the goals of contemporary information technology education and the cultivation of core competencies required for the twenty-first century.

Recommendation

From the research on the development of STAD cooperative learning achievement and students satisfaction using STAD cooperative learning techniques on Python Programming Language knowledge learning for 8th grade students in the fall semester of 2024 at Honggui Middle School, the researcher has suggestions as follows:

Suggestions for utilizing the research results

1. Each learning activity using STAD cooperative learning techniques requires students to perform the activity continuously for a specified period of time. Therefore, teachers should prepare documents and materials for activities according to the lesson plan to be ready and sufficient for students. This will allow students to have enough time to perform activities.

2. Organizing learning activities on using STAD cooperative learning techniques for 8th grade students in the fall semester of 2024 at Honggui Middle School, there are considerations as follows:

2.1 Before learning activities, teachers need to explain to students the basic knowledge of STAD cooperative learning techniques so that students can understand their roles and responsibilities. This will enable students to be able to perform properly. And the process of teaching activities clearly including reviewing the basic knowledge in the content according to the knowledge sheet in each lesson plan first, this helps students to understand the content easier.

2.2 during learning activities, because of the learning activities on Python Programming Language knowledge learning using STAD cooperative learning technique,

it is a group learning activity. Therefore, teachers should provide groups of students who encounter problem with counseling, advice and help, so that students can learn with their full potential.

2.3 After the learning activities, teachers are required to have a test after class. If a student is absent from school, the teacher must instruct the student to study the knowledge sheet in the lesson plan individually. And teachers to provide advice and mentor ship outside of school hours. Taking an achievement test after the student has studied the knowledge sheet.

2.4 spending time on lesson plan. Time spent on learning activities specified in the lesson plan and taking some time on the forecast for the performance of each stage of the activity. During the actual activity, there may be some discrepancies in the timing of the activities for each stage. Therefore, the learning activities can be flexible in time as appropriate.

Suggestions for the next research

1. Research should be done to develop learning achievement by using STAD cooperative learning techniques in other subjects to study whether this type of learning is suitable for students in any grade level or which group of learning subjects are most appropriate.

2. Research should be conducted using a learning plan and data collection tools with other samples in order to obtain accurate and highly reliable educational results.

3. There should be a comparison of the results of using STAD cooperative learning technique with other learning innovations on the Python Programming Language knowledge learning.

References

- Gillies, R. M. (2016). Cooperative learning: Review of research and practice. *Australian Journal of Teacher Education*, 41(3), 39–54.
<https://doi.org/10.14221/ajte.2016v41n3.3>

- Grover, S., & Pea, R. (2013). Computational thinking in K-12: A review of the state of the field. *Educational Researcher*, 42(1), 38-43.
<https://doi.org/10.3102/0013189X12463051>
- Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher*, 38(5), 365-379. <https://doi.org/10.3102/0013189X09339057>
- Ministry of Education of the People's Republic of China. (2022). *Compulsory education information technology curriculum standards (2022 edition)*. Beijing, China: People's Education Press.
- Slavin, R. E. (2015). *Cooperative learning: Theory, research, and practice* (2nd ed.).
- Shute, V. J., Sun, C., & Asbell-Clarke, J. (2017). Demystifying computational thinking. *Educational Research Review*, 22, 142-158.
<https://doi.org/10.1016/j.edurev.2017.09.003>
- Tikva, C., & Tambouris, E. (2021). A systematic mapping study on teaching and learning computational thinking through programming in K-12 education. *Thinking Skills and Creativity*, 41, 100849. <https://doi.org/10.1016/j.tsc.2021.100849>
- Wing, J. M. (2006). Computational thinking. *Communications of the ACM*, 49(3), 33-35.
<https://doi.org/10.1145/1118178.1118215>
- Yadav, A., Stephenson, C., & Hong, H. (2017). Computational thinking for teacher education. *Communications of the ACM*, 60(4), 55-62.
<https://doi.org/10.1145/2994591>