

A Comparative Study of Current Conditions in Leisure Time of Secondary Students

Sirichot Ketkham, Wuttiporn Suamuang, and Surachai Suksakulchai

King Mongkut's University of Technology Thonburi, Thailand

Email: sirichot.keti@kmutt.ac.th, wuttiporn.sua@kmutt.ac.th, surachai.suk@kmutt.ac.th

Abstract—Leisure time is limited, and spending valuable leisure time can affect self-improvement and improve students' quality of life. However, leisure time management varies by grade level and leisure hours. Accordingly, the current study aimed to explore the effect of grade levels and leisure hours on leisure time management. Moreover, this study compared to time spent on leisure and enforced leisure activities between school days and weekends. The participant included 398 high school students selected by stratified random sampling. A self-report survey adapted from previous studies was employed to explore leisure hours and enforced leisure and leisure time management. The reliability of the survey was acceptable. The results using ANOVA found that goal and priority setting differed by grade level. Students in higher grade levels had more goal and priority setting than those in lower grade levels. Furthermore, there was a difference in leisure hours in leisure time management. Students with lower leisure time were likely to possess higher leisure time management. The current findings further revealed that time spent on leisure and enforced leisure activities differed between school days and weekends. Students engaged in leisure and enforced leisure activities on weekends more than on school days. These results provide insight for instructors or teachers to support students' behaviors in their free time.

Index Terms—free time, goal and priority setting, leisure time, leisure time management, resourcefulness

I. INTRODUCTION

Time is a limited resource, which students have the same 24-hour time, and they cannot reuse it or turn the clock back. Therefore, students are necessary to manage their time as efficiently as possible [1]. Spending valuable leisure time can affect self-improvement and improve students' quality of life [2].

Leisure is defined as “When we choose or decide to do an activity when we feel like doing it.” [3]. For the present research, the definition of free time is divided into two types. The first is free time that students choose or decide to do when they feel comfortable doing it with the freedom of choice called “Leisure Time.” Another one is enforced leisure, in which students need to spend their free time on enforced activities and living, such as taking a shower, eating, and washing clothes [4]. Moreover, students still spend their time doing housework, doing homework, taking extra classes, or earning extra money. An important factor affecting leisure time is leisure time management,

which is defined as behaviors in spending free time on students' activities efficiently, including setting goals to accomplish. Andy Bertsch, *et al.* [5] mentioned five free Time management constructs: goals and priority setting, values, resourcefulness, skill, and planning. These five constructs were related to each other. Moreover, effectively free time management influences students' learning, academic achievement, work quality, intention, and self-improvement [6]. Time allocation is a barrier affecting students' work because students cannot complete homework when they possess low time allocation [7]. Therefore, the current study focuses on studying the current conditions and needs in students' leisure time. The current results would guide teachers to organize and design teaching and learning activities in accordance with the needs of students.

A. Leisure Time

Behaviors of free time of undergraduate students were significantly different on year levels because the learning course was various. Students are independent to learn in their free time and provide them to get more experiences. For example, Ludv k *et al.* [8] revealed that students who took their leisure time on ICT are prone to increase experience in ICT. Hence, usually, students allocate their free time based on their lifestyles and suitable for themselves. For example, students who have homework spend most of their time studying. Some students who need to gain more income spend their time on special jobs [7]. The behavior of students with high academic achievement engaged in academic activities more than students with low academic achievement. Students involved in distinct activities had significant differences in academic achievement [9]. Leisure time impacted the quality of life [10]. Yeo *et al.* [11] stated that sleeping time and media use were associated with studying duration.

B. Effects of Free Time Management on Leisure Time

Andy Bertsch *et al.* [5] studied the free time management of university students in the USA and found that students who worked part-time less than 20 hours per week were more planned than those who worked more than 20 hours per week. Students who have free time less than 14 hours per week are likely to prioritize and set goals in their leisure time more than students who have free time more than 14 hours per week. Students who learned more than 16 credit hours a semester tend to have a goal and priority Setting, values, resourcefulness, and skill more than those who learn less than 16 credit hours a semester.

Manuscript received April 11, 2022; revised November 22, 2022.

In addition, Sunari [10] explored the relationship between leisure-time behavior and students' learning style, and these research findings found that students who like to exercise were likely to avoid learning, such as unintentional agreeable with Wuttiporn Suamuang *et al.* [12]. The sample group stated that the affected work performance is time management.

II. PURPOSE AND RESEARCH QUESTIONS

This study aimed to explore students' leisure and enforced Leisure time in different grade levels. The specific research questions were:

- Does goal and priority setting differ for grade levels?
- How does leisure time management differ for leisure hours?
- How does time spent on leisure and enforced leisure activities differ between school days and weekends?

III. METHODS

A. Participants

The population included secondary students in the Secondary Educational Service Area Office Bangkok 1, Thailand. The population consisted of 52,479 students [13].

The sample included 398 students selected by stratified random sampling [14]. The sample size is based on the Taro Yamane Method. The sample for this study had 148 males (37.2 percent) and 250 (63 percent) females (a total of 398). They were studying in grades 10–12 from three schools. There were 132 students in grade 10 (34.4 percent), 194 students in grade 11 (46.2 percent), and 72 students in grade 12 (19.4 percent). Table I shows the descriptive statistic of this study.

TABLE I. FREQUENCY OF GENDER AND YEAR LEVELS IN THE STUDY

Grade levels	Male		Female		Total	
	N	Percent	N	Percent	N	Percent
Grade 10	42	10.6	90	22.6	132	33.2
Grade 11	83	20.9	111	27.9	194	48.8
Grade 12	29	7.3	43	10.8	72	18
Total	154	38.8	244	61.3	398	100

B. Measures

The current study used a self-report survey designed to compare differences in grade levels, leisure hours, and enforced leisure of secondary students. There were seven items for task leisure and enforced leisure, and participants could respond in terms of a nominal scale. Participants could respond using a Likert-type scale, which 1 strongly disagrees, 2 shows disagree, 3 represents neutral, 4 is agree, and 5 strongly agrees.

In terms of leisure time management, the survey was adapted from [5] in terms of leisure time management. This survey comprised of four constructs, as shown in Table II. The first was the goal and priority setting, defined as clearly setting goals to do activities in the leisure time. Moreover, students have to evaluate the goals and whether it was successful. This construct had four items, which Cronbach's alpha showed acceptable ($\alpha = 0.75$). The second construct was values, which referred to

determining the importance of what to do that is appropriate for students' own lives, including happiness of doing the activities. This construct had four items, and the reliability was acceptable ($\alpha = 0.70$). Resourcefulness was the third construct, which included four items ($\alpha = 0.66$). This construct refers to taking notes of situations, problems, and important things with a note-taking tool and using other materials for time management. The last construct was planning, defined as preparing to achieve planned actions and goals. This construct consisted of five items, which Cronbach's alpha presented as acceptable ($\alpha = 0.77$).

TABLE II. THE CONSTRUCTS AND ITEMS FOR LEISURE TIME MANAGEMENT

Construct	Item	Cronbach's alpha
Goal and Priority Setting	I always set goals to spend in my leisure time effectively. I always evaluate using my leisure time to ensure my goals achieved. I always make a list of things to do in my leisure time. I plan and schedule my leisure time daily and weekly.	0.75
Values	During leisure time I am always happy. I know what to do in my leisure time.	0.70
Resourcefulness	I can always predict when I have leisure time. I think that planning my leisure time is spending time on the most useful things. I have goals to accomplish in my leisure time. I spend my free time doing useful things. I use a note-taking tool (such as a notebook, phone, computer, etc.) to record important things. I donnot want anyone to disturb me in my free time.	0.66
Planning	I will schedule in advance what to do in my leisure time. I plan ahead of time what I will do in my leisure time. I am always with my family, playing sports or other activities that I enjoy. I spend my leisure time doing school activities with my friends. I find additional important information related to leisure activities (e.g., fins a place to travel, how to play sports to improve skills) in my leisure time	0.77

4 hours (Mean =3.53, sd =0.73). Table V demonstrates descriptive statistics for leisure time management divided by leisure hours of school days.

TABLE VI. DESCRIPTIVE STATISTICS FOR LEISURE TIME MANAGEMENT DIVIDED BY LEISURE HOUR OF SCHOOL DAYS

Construct	The number of leisure time							
	Less than 1 hr		1-2 hr		3-4 hr		More than 4 hr	
	M	SD	M	SD	M	SD	M	SD
Goal and Priority	3.7 0	0.8 5	3.6 5	0.6 5	3.5 4	0.8 8	3.2 8	1.0 5
Setting Values	4.0 1	0.7 3	3.8 1	0.6 1	3.9 9	0.6 9	4.0 0	0.6 7
Resourcefulness	3.5 7	1.0 1	3.8 3	0.5 6	3.6 6	0.6 9	3.4 7	0.8 6
Planning	3.4 7	1.0 7	3.8 9	0.6 8	3.5 4	0.7 3	3.3 4	1.0 5

From Table VI, construct of leisure time management in Table V, *Goal and Priority Setting* showed that most students have leisure time less than 1 hour (Mean =3.70, sd=0.85), *Values* showed that most students have leisure time less than 1 hour (Mean =4.01, sd=0.73), and *Resourcefulness* showed that most students have leisure time 1-2 hour (Mean =3.83, sd =0.56), *Planning* showed that most students have leisure time 1-2 hour (Mean =3.89, sd =0.68).

Leisure hour on weekend or holiday

The comparison of the number of leisure time of **weekend or holiday** on leisure time management is presents in Table VII. The results found that there was a significant effect of leisure hours on resourcefulness ($F(3, 394) = 3.36, p <0.05$) and Planning ($F(3, 394) = 3.01, p <0.001$). However, no significant differences were identified for goal and priority setting and values.

TABLE VII. DIFFERENCES IN LEISURE HOURS OF WEEKENDS OR HOLIDAY ON FREE TIME MANAGEMENT

Construct	Leisure hour on school day (Monday to Friday)				
	Variance	SS	df	MS	F-ratio
Goal and Priority Setting	Between Groups	2.68	3	0.89	0.23
	Within Groups	245.00	394	0.62	
	Total	247.69	397		
Values	Between Groups	1.24	3	0.41	3.36*
	Within Groups	165.15	394	0.42	
	Total	166.39	397		
Resourcefulness	Between Groups	4.58	3	1.53	3.36*
	Within Groups	178.87	394	0.45	
	Total	183.44	397		
Planning	Between Groups	5.74	3	1.91	3.01*
	Within Groups	250.21	394	0.64	
	Total	255.95	397		

Note *p<0.05

To consider in each leisure time period, pertaining to resourcefulness, Post hoc comparison using the Tukey test found that students who had leisure hours less than 1 hour (Mean = 3.38, sd =0.93) had resourcefulness higher than students who had leisure hours between 1-2 hours (Mean =3.93, sd =0.59)

In terms of planning, students who had leisure hours less than 1 hour (Mean = 3.31, sd =1.14) made a plan for leisure time more than students who had leisure hours between 1-2 hours (Mean =3.91, sd =0.62). Table VIII demonstrates descriptive statistics for leisure time management divided by leisure hour of weekend or holiday.

TABLE VIII. DESCRIPTIVE STATISTICS FOR LEISURE TIME MANAGEMENT DIVIDED BY LEISURE HOUR OF WEEKEND OR HOLIDAY

Construct	The number of leisure time							
	Less than 1 hr		1-2 hr		3-4 hr		More than 4 hr	
	M	SD	M	SD	M	SD	M	SD
Goal and Priority Setting	3.6 2	1.0 0	3.7 5	0.6 2	3.5 1	0.7 0	3.5 7	0.88
Values	3.9 7	0.9 10	3.7 7	0.6 2	3.8 8	0.6 1	3.9 3	0.66
Resourcefulness	3.3 8	0.9 3	3.9 3	0.5 9	3.7 2	0.6 6	3.6 9	0.69
Planning	3.3 1	1.1 3	3.9 1	0.6 8	3.7 5	0.7 7	3.6 5	0.84

C. The Comparison of Time Spent on Leisure and Enforced Leisure Activities between School Days and Weekends

TABLE IX. TIME SPENT ON LEISURE AND ENFORCED LEISURE ACTIVITIES BETWEEN SCHOOL DAYS AND WEEKENDS

LEISURE AND ENFORCED LEISURE ACTIVITIES	TIME SPENT ON ACTIVITES				T	P
	School days	SD	Weekend	SD		
Sleep hours	1.79	0.45	2.22	0.61	-13.04	< 0.001
Leisure hours	3.45	0.80	4.23	0.85	-18.30	< 0.001
Homework hours	3.14	0.62	3.21	0.77	-2.00	< 0.05
Housework hours	2.62	0.60	2.87	0.69	-8.66	< 0.001
Tutoring extra hours	2.55	0.60	2.95	0.86	-12.27	< 0.001
Part-time job hours	1.25	0.85	1.51	1.24	-4.99	< 0.001

Note(s) *p<0.05, **p<0.01, ***p<0.001

A paired-sample t-test was conducted to compare leisure and enforced leisure activities between school days and weekends. The results found that there was a significant difference of the sleep hours ($t(397)=-13.04$, $p < .001$), leisure hours ($t(397)=-18.30$, $p < 0.001$), homework hours ($t(397)=-2.00$, $p < 0.05$), housework hour ($t(397)=-8.66$, $p < 0.001$), tutoring extra hours ($t(397)=-12.27$, $p < 0.001$), and part-time job hours ($t(397)=-4.99$,

4 hours (Mean =3.53, sd =0.73). Table V demonstrates descriptive statistics for leisure time management divided by leisure hours of school days.

TABLE VI: DESCRIPTIVE STATISTICS FOR LEISURE TIME MANAGEMENT DIVIDED BY LEISURE HOUR OF SCHOOL DAYS

Construct	The number of leisure time							
	Less than 1 hr		1-2 hr		3-4 hr		More than 4 hr	
	M	SD	M	SD	M	SD	M	SD
Goal and Priority	3.7 0	0.8 5	3.6 5	0.6 5	3.5 4	0.8 8	3.2 8	1.0 5
Setting Values	4.0 1	0.7 3	3.8 1	0.6 1	3.9 9	0.6 9	4.0 0	0.6 7
Resourcefulness	3.5 7	1.0 1	3.8 3	0.5 6	3.6 6	0.6 9	3.4 7	0.8 6
Planning	3.4 7	1.0 7	3.8 9	0.6 8	3.5 4	0.7 3	3.3 4	1.0 5

From Table VI, construct of leisure time management in Table V, *Goal and Priority Setting* showed that most students have leisure time less than 1 hour (Mean =3.70, sd=0.85), *Values* showed that most students have leisure time less than 1 hour (Mean =4.01, sd=0.73), and *Resourcefulness* showed that most students have leisure time 1-2 hour (Mean =3.83, sd =0.56), *Planning* showed that most students have leisure time 1-2 hour (Mean =3.89, sd =0.68).

Leisure hour on weekend or holiday

The comparison of the number of leisure time of **weekend or holiday** on leisure time management is presents in Table VII. The results found that there was a significant effect of leisure hours on resourcefulness ($F(3, 394) = 3.36, p <.05$) and Planning ($F(3, 394) = 3.01, p <.001$). However, no significant differences were identified for goal and priority setting and values.

TABLE VII: DIFFERENCES IN LEISURE HOURS OF WEEKENDS OR HOLIDAY ON FREE TIME MANAGEMENT

Construct	Leisure hour on school day (Monday to Friday)				
	Variance	SS	df	MS	F-ratio
Goal and Priority Setting	Between Groups	2.68	3	0.89	0.23
	Within Groups	245.00	394	0.62	
	Total	247.69	397		
Values	Between Groups	1.24	3	0.41	3.36*
	Within Groups	165.15	394	0.42	
	Total	166.39	397		
Resourcefulness	Between Groups	4.58	3	1.53	3.36*
	Within Groups	178.87	394	0.45	
	Total	183.44	397		
Planning	Between Groups	5.74	3	1.91	3.01*
	Within Groups	250.21	394	0.64	
	Total	255.95	397		

Note *p<0.05

To consider in each leisure time period, pertaining to resourcefulness, Post hoc comparison using the Tukey test found that students who had leisure hours less than 1 hour (Mean = 3.38, sd =0.93) had resourcefulness higher than students who had leisure hours between 1-2 hours (Mean =3.93, sd =0.59)

In terms of planning, students who had leisure hours less than 1 hour (Mean = 3.31, sd =1.14) made a plan for leisure time more than students who had leisure hours between 1-2 hours (Mean =3.91, sd =0.62). Table VIII demonstrates descriptive statistics for leisure time management divided by leisure hour of weekend or holiday.

TABLE VIII: DESCRIPTIVE STATISTICS FOR LEISURE TIME MANAGEMENT DIVIDED BY LEISURE HOUR OF WEEKEND OR HOLIDAY

Construct	The number of leisure time							
	Less than 1 hr		1-2 hr		3-4 hr		More than 4 hr	
	M	SD	M	SD	M	SD	M	SD
Goal and Priority Setting	3.6 2	1.0 0	3.7 5	0.6 2	3.5 1	0.7 0	3.5 7	0.88
Values	3.9 7	0.9 10	3.7 7	0.6 2	3.8 8	0.6 1	3.9 3	0.66
Resourcefulness	3.3 8	0.9 3	3.9 3	0.5 9	3.7 2	0.6 6	3.6 9	0.69
Planning	3.3 1	1.1 3	3.9 1	0.6 8	3.7 5	0.7 7	3.6 5	0.84

C. The Comparison of Time Spent on Leisure and Enforced Leisure Activities between School Days and Weekends

TABLE IX. TIME SPENT ON LEISURE AND ENFORCED LEISURE ACTIVITIES BETWEEN SCHOOL DAYS AND WEEKENDS

LEISURE AND ENFORCED LEISURE ACTIVITIES	SCHOOL DAYS	TIME SPENT ON ACTIVITIES	T	P
	SD	WEEKENDS	SD	
Sleep hours	1.79	0.45	2.22	0.61 -13.04 <.001
Leisure hours	3.45	0.80	4.23	0.85 -18.30 <.001
Homework hours	3.14	0.62	3.21	0.77 -2.00 <.05
Housework hours	2.62	0.60	2.87	0.69 -8.66 <.001
Tutoring extra hours	2.55	0.60	2.95	0.86 -12.27 <.001
Part-time job hours	1.25	0.85	1.51	1.24 -4.99 <.001

Note(s) *p<0.05, **0.05<p<0.01, ***p<0.001

A paired-sample t-test was conducted to compare leisure and enforced leisure activities between school days and weekends. The results found that there was a significant difference of the sleep hours ($t(397)=-13.04, p < .001$), leisure hours ($t(397)=-18.30, p < .001$), homework hours ($t(397)=-2.00, p < .05$), housework hour ($t(397)=-8.66, p < .001$), tutoring extra hours ($t(397)=-12.27, p < .001$), and part-time job hours ($t(397)=-4.99, p < .001$).

p< 0.001) on school day and weekends. Students spent leisure time on activities of weekend more than school day. For example, Students spend more time sleeping, doing homework, housework, and Part-time job on weekends than school days. Table IX shows time spent on leisure and enforced activities between school day and weekend.

V. DISCUSSION

This section presents discussion in accordance with research questions.

RQ1: Does goal and priority setting differ for grade levels?

The current results found that goal and priority setting differed by grade levels. Students who were in higher grade levels had more goal and priority setting than those who were in lower grade levels. This result is consistent with Khetthai Sinthusuwon [2] that claimed that students in higher grade levels tend to work with greater responsibility, resulting in the development of leisure time management, including goal and priority setting. As well as higher education, Unphisa Rarongkham [7] also stated that students' behavior of spending leisure time differed for year levels.

RQ2: How does leisure time management differ for leisure hours?

For this research, leisure time was divided into two periods, which were school days and weekends.

In terms of school days, there was a difference of leisure hours on leisure time management. students who had leisure hours less than 1 hour set and prioritized goals more than those who had leisure hours more than 4 hours. In terms of resourcefulness, students who had leisure hours between 1-2 hours presented resourcefulness higher than students who had leisure hours more than 4 hours. For planning, students who had leisure hours between 1-2 hours made a plan for leisure time more than students who had leisure hours more than 4 hours and between 3-4 hours. Hence, the results can conclude that students with lower leisure time were likely to possess higher leisure time management. The reason for this answer is because students have to manage a small amount of free time to complete various activities in that time limit. Andy Bertsch, *et al.* [5] finding also supports the current results. They found that students with lower free time were more likely to use goals and prioritize and on their free time. Additionally, they also were highly resourceful as well.

RQ3: How does time spent on leisure and enforced leisure activities differ between school days and weekends?

The results of the present study found that time spent on leisure and enforced leisure activities differed for between school days and weekends. Students engaged leisure and enforced leisure activities on weekends more than school days. Petra Nováková [15] identified that activities between school days and holidays were different. Students spend their leisure time on physical activities for school days. In other hand, students spend their leisure time on enforced activities for weekends. Therefore, Students must allocate their limited free time appropriately to complete tasks that need to be accomplished [1].

VI. STUDY LIMITATIONS AND DIRECTIONS

There were limitations of the current study that should be concerned. Firstly, the sample size was limited to a specific area. Therefore, the next research may use a larger sample size, covering various areas to gain an obvious result. The number of males and females is not balanced because the number of female students in Thailand is higher than the number of male students. Moreover, more variables affecting students' leisure time should be examined, such as motivation to do leisure activities.

VII. CONCLUSION

Leisure time is limited, and spending valuable leisure time can affect self-improvement and improve students' quality of life. However, leisure time management varies by grade level and leisure hours. Accordingly, the current study aimed to explore the effect of grade levels and leisure hours on leisure time management. Moreover, this study compared to time spent on leisure and enforced leisure activities between school days and weekends. The results using ANOVA found that goal and priority setting differed by grade level. Students in higher grade levels had more goal and priority setting than those in lower grade levels. Furthermore, there was a difference in leisure hours on leisure time management, and students with lower leisure time were likely to possess higher leisure time management. The current findings further revealed that time spent on leisure and enforced leisure activities differed between school days and weekends. Students engaged in leisure and enforced leisure activities on weekends more than on school days. These results provide insight for instructors or teachers to support students' behaviors in their free time.

CONFLICT OF INTEREST

The authors declare no conflict of interest

AUTHOR CONTRIBUTIONS

Sirichot ketkam collected and analyzed data. In addition, he wrote this article. Surachai Suksakulchai designed the methodology and approved the final version. Wuttiporn Suamuang wrote this article and approved the final version.

REFERENCES

- [1] Office of the Permanent Secretary of Thailand, Document on time Management, 2010, pp. 4-8.
- [2] K. Sinthusuwon, "The mixed methods action research to develop a model of promoting useful leisure behavior of the non-formal students in nakhon pathom province," 2019, pp. 15-20.
- [3] Office of Sport and Recreation Development of Thailand, Guide for Recreational Leaders, 2019, pp. 1-10.
- [4] Office of Sport and Recreation Development of Thailand, Development of a Free Time Study Model for Students in the First Grade, 2012, pp. 12-20.
- [5] A. Bertsch, J. Ondracek, M. Saeed, C. Stone, K. Erickson, K. Opdahl, *et al.*, Free Time Management of University Students in the USA, 2020, pp. 3-10.
- [6] B. Omodan, *Decolonization of Knowledge-Construction in University Classrooms: The Place of Social Constructivism*, p. 197.
- [7] U. Rarongkham and C. Charpavang, The Relationship between Leisure Behaviors and Learning Styles of Undergraduate Students in Mahasarakham University, 2021, pp. 9-13.

- [8] G. O. Young, "Synthetic structure of industrial plastics," in *Plastics*, 2nd ed. vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15-64.
- [9] P. Boonkerd, Appropriate time Management of Students Kasetsart University Sriracha Campus, 2020, pp. 49-50.
- [10] S. Chulapan, Leisure Time and Learning Style of Students in Faculty of Industrial Education of Rajamangala University of Technology Pra Nakon, 2018, pp. 10-12.
- [11] Yeo, et al, Associations of Time Spent on Homework or Studying with Nocturnal Sleep Behavior and Depression Symptoms in Adolescents from SINGAPORE, 2020, pp. 1-5.
- [12] W. Suamuang, *Factors Affecting Assignment Completion in Higher Education*, 2021, pp. 8-10.
- [13] OBEC. Information of schools under NIDA, NEDA [Central Region], Bangkok Secondary Education Service Area Office, District 1. (2019). [Online]. pp. 12-20. Available: http://eme1.obec.go.th/~eme62/schoolonfed.php?module=school&option=show_school&area=108
- [14] S. Vanderstoep and D. Johnston, *Research Methods in Everyday Life: Blending Qualitative and Quantitative Approaches*, 2009, pp. 1-5.
- [15] P. Nováková, *School and Weekend Physical Activity of 15-16 Year-old Czech, Slovak and Polish Adolescents*, 2011, pp. 2-5.

Copyright © 2022 by the authors. This is an open access article distributed under the Creative Commons Attribution License ([CC BY-NC-ND 4.0](#)), which permits use, distribution and reproduction in any medium, provided that the article is properly cited, the use is non-commercial and no modifications or adaptations are made.



Sirichot Ketkham is final year master student at Electrical Technology Education Department, Faculty of Industrial Education and Technology, King Mongkut's University of Technology Thonburi, Thailand. His research relates to teaching and learning in the area of computer.



Wuttiporn Suamuang is an instructor at Electrical Technology Education Department, Faculty of Industrial Education and Technology, King Mongkut's University of Technology Thonburi, Thailand. Her research relates to teaching and learning in the area of computer. She got a scholarship for her Ph.D. in 2016



Surachai Suksakulchai is an associate professor at the Electrical Technology Education Department, Faculty of Industrial Education and Technology, King Mongkut's University of Technology Thonburi, Thailand. He received his bachelor's degree in Electrical Technology Education in 1985 and Electrical Engineering in 1987 from King Mongkut's University of Technology Thonburi, Thailand. He also received master's and doctoral degrees in Electrical Engineering at Vanderbilt University, USA. His current research includes robotics, electrical education, and robot-based education.