

The effect of the successful intelligence interactive module on Universiti Utara Malaysia students' analytical, creative and practical thinking skills

Nurulwahida Azid  and Ruzlan Md-Ali 

School of Education and Modern Languages, Universiti Utara Malaysia, Sintok Kedah, Malaysia
nurulwahida@uum.edu.my

The study reported on here aimed to examine the effectiveness of the successful intelligence interactive module (SIIM) that employs thinking skills using the successful intelligence theory. This was an empirical study that used mixed method analysis. The rationale for the development of this interactive module was to increase the analytical, practical, and creative thinking skills score among undergraduates in the education programme at Universiti Utara Malaysia (UUM). We administered a quasi-experimental design with pre-tests and post-tests to 70 UUM undergraduates in the education programme. The participants were randomly selected and divided into a control group and an experimental group. The ANCOVA test result showed that SIIM was effective in increasing the respondents' analytical, practical, and creative thinking skills scores. Overall, the findings showed that the teaching approach of using the interactive module was effective in enhancing analytical, creative and practical thinking skills. This study provides positive implications for undergraduates' soft skill development in preparation for their future careers.

Keywords: ANCOVA; curriculum design; educational effectiveness; higher-order thinking skills; interactive module; intraclass correlation coefficient; mixed method; problem solving; successful intelligence theory; Universiti Utara Malaysia

Introduction

At present, educators demand that the education system should help students make sense of the rapidly changing world because future careers are being created on a daily basis – especially for students in the higher learning level. It cannot be denied that the youth, students in particular, have a great responsibility. Dynamic intellectual capital is a human capital that is able to think and thrive in line with the transformation of the Fourth Industrial Revolution (IR 4.0) (Souza, 2017). Therefore, it is important to cultivate thinking skills among university students so that they can solve problems and make decisions as they will be the future leaders. This is true since competitive economic success is based on strategic allocation of physical and financial resources, and even more focused on intellectual capital management strategies (Xu & Wang, 2018). Intellectual capital, on the other hand, is a human capital development strategy that can drive the economic development of a country (Alawamleh, Ismail, Aqeel & Alawamleh, 2019). Apart from Malaysia, this matter applies to other countries like South Africa as research has indicated the need for university students to learn creative thinking, which is thinking beyond the series of normal levels of cognition practiced in schools (Moodley, 2013). Based on this awareness, university students should not only emphasise their academic performance, but also analytical, creative and practical thinking skills to enable them to make analytical, creative, and practical decisions in their daily lives. Babaei, Maktabi, Behrozi and Atashafroz (2016) indicate that successful intelligence theory highlights the need to produce excellent university students with the ability to think critically. Generations who strive towards the future are the generations who have the following abilities: 1) to differentiate between good and bad (analytical thinking skill); 2) to generate ideas and other alternatives when considering their decisions (creative thinking skill); and 3) to sustain their abilities (practical thinking skill) through effective decision-making in their daily lives, which can indirectly contribute towards the prosperity of society (Sternberg, Lipka, Newman, Wildfeuer & Grigorenko, 2016). Hence, the education programme should incorporate problem-solving activities to develop and sustain analytical, creative, and practical thinking among university students.

Rationale

Every year, the number of qualified students applying for places at the Malaysian Public Institute of Higher Learning increases, creating a competitive atmosphere among the students. However, the students' excellence in academic achievement is not a guarantee that they will excel at the Malaysian Public Institute of Higher Learning (Kör, Erbay, Demir & Akmeşe, 2016; Othman, 2006). Noteworthy, only 2.8% ($n = 1,660$) of the students from 17 Malaysian public institutes of higher learning had managed to achieve cumulative grades between 3.7 and 4.00 (Othman, 2006). Othman (2006) proves that students from Malaysian public institutes of higher learning do not display excellent performance, only excellent students were accepted through the merit system. It is believed that students in the education programme should be equipped with thinking skills, which is one of the soft skills required in today's education, in addition to the skills and mastery in knowledge-related subjects (Patacsil & Tablitan, 2017). In a study on employers' perspectives on the marketability of diploma and bachelor's degree graduates, Ismail (2012) revealed that there was a gap between the actual performance of the graduates and what employers expected of them. A gap analysis of marketability for skills such as decision-making and problem solving, shows that there is a big gap (see Table 1). The big gap between the actual

performance of the graduates and what is expected by the employers has resulted in steep competition in the workforce.

Given the gap identified between the actual performance and employers' expectations of performance, university students need to be better equipped to be competitive in the workforce by securing soft skills needed to function in the work

environment. Statistics on unemployment from 2009 to 2016 reveal that the unemployment rate in Malaysia was at 3.2% with 501,500 people out of jobs (Department of Statistic Malaysia, 2016). Attention needed to be given to develop thinking and problem-solving skills among Universiti Utara Malaysia undergraduate students.

Table 1 Gap analysis of marketability characteristics based on employers' level of importance (Ismail, 2012)

Soft skills based on employers' level of importance	M / Average		Gap	Order of importance
	Actual performance	Expected performance		
Communication and interpersonal	7.04	8.73	-1.69	3
Making decisions and solving problems	6.84	8.60	-1.76	1
ICT (information and communications technology)	7.65	8.65	-1.00	9
Leadership	7.15	8.69	-1.54	7
Teamwork	7.26	8.79	-1.53	8
Working plan	7.03	8.59	-1.57	5
Thinking skills	6.89	8.62	-1.73	2
Ethics and values	7.30	8.94	-1.64	4
Other skills	6.96	8.51	-1.55	6

The issue of thinking skills is not only a major issue in Malaysian education, but also in other countries. For instance, the National Curriculum and Assessment Policy Statements (CAPS) Grades R-12 suggests that critical and creative thinking are the critical learning outcomes that should be addressed in the national education system (Department of Basic Education, Republic of South Africa, 2017). Researchers and lecturers at one of the South African universities have been conducting studies on thinking skills for the undergraduate teaching programme (Green, Condry & Chigona, 2012). Hence, we believe that a study on how to instil thinking skills in order to increase Malaysian students' thinking skills scores should be conducted.

Currently, the Malaysian education system emphasises that students should be academically excellent and capable of making decisions through analytical, creative, and practical thinking (Ministry of Education Malaysia, 2013; Sternberg, 2018). It is crucial to instil students with problem-solving skills, which is in line with Sternberg (2018) who states that excellent graduates are those who are able to maintain their analytical, creative, and practical thinking stability. For instance, Sternberg's (2018) study shows that some students are excellent in analytical thinking skills but weak in creative and practical thinking skills. Therefore, problem-solving activities in the classroom should be provided to stimulate the three types of thinking in learning.

Since the 1990s, culturally relevant pedagogy was taught intensively in the Western education programme (Bassey, 2016). It was made popular by scholars and practitioners as an effective pedagogical tool to interact with students coming from various backgrounds (Zainuddin & Halili, 2016). Cul-

turally relevant pedagogy refers to the use of culture and the students' strength as the bridge to obtain success in the education institution (Bassey, 2016; Martell, 2018). Hence, the implementation of culturally relevant pedagogy should be applied in teaching to prepare students as future leaders who can meet the challenges of addressing social issues in Malaysia. In fact, Malaysian multicultural, racial and religious beliefs are in line with the aspiration for culturally relevant pedagogy. Therefore, this study has constructed the pedagogic tool, SIIM, based on the current issues in the students' everyday lives, using computer technology in teaching. Martell (2018) states that culturally relevant pedagogy can validate students' life experiences through their cultures and histories as teaching resources in the classroom. The application of successful intelligence theory (comprising of analytical, creative and practical thinking skills) creates a conducive environment to create culturally relevant pedagogy in the education system. The purpose of SIIM is to provide a teaching tool that incorporates learning activities related to social issues that occur in Malaysian society. This is because Malaysia is a country with many cultures and customs as a result of its multi-ethnic citizens, namely Malay, Chinese and Indian, with three main different languages. Tasks provided in this interactive application require of students to solve issues that are addressed using analytical, creative and practical thinking skills. The results of this study are intended to provide evidence to lecturers at the Universiti Utara Malaysia that the application of culturally relevant pedagogy is one of the ways to unite the multi-racial Malaysian community.

This study was guided by the following research questions:

- 1) Is there any significant difference in the University

- Utara Malaysia students' post-test analytical thinking skill scores compared to the pre-test? (H_1)
- 2) Is there any significant difference in the University Utara Malaysia students' post-test practical thinking skill scores compared to the pre-test? (H_2)
 - 3) Is there any significant difference in the University Utara Malaysia students' post-test creative thinking skill scores compared to the pre-test? (H_3)
 - 4) What are the perspectives of the students in the experimental group towards the use of the successful intelligence interactive module (SIIM)?

Three null hypotheses were formulated based on the three thinking skills and it was found that there were no significant differences between the control and experimental groups on any of the thinking skill construct measures.

The Conceptualisation of Successful Intelligence Theory

Sternberg (2018) proposed the successful intelligence theory which introduces the different perspectives of thinking compared to the traditional thinking theory in the sense that this theory emphasises the thinking skills which are applicable in our daily lives. It is believed that most individuals would be excellent in at least one of the three or in all three thinking skills. However, there are instances where an individual could be weak in all three thinking skills.

In general, analytical thinking skills are used to process information when analysing and evaluating ideas. The individual needs to see and understand the situations thoroughly. According to Sternberg (2018), analytical thinking skills are required for students to analyse, evaluate, decide, compare and contrast, explain causes and consequences, examine small-part relationships as a whole, make assumptions, make predictions, infer and solve problems.

Thinking creatively, or the experience of sub-theory, explains the influence of past experiences in implementing cognitive tasks (Sternberg, 2018). Individuals use creative thinking skills to determine the suitable choices in solving daily life problems (Martz, Hughes & Braun, 2017; Sternberg, 2018). Creative ideas can be developed dynamically and they are multi-purposed. Old ideas can be traced through new dimensions and new elements, which can be explained concretely. According to Sternberg (2018), practical thinking skills associates thinking with the real environment which is relevant to the life of an individual. The essential aspect of practical thinking is the acquisition and use of tacit knowledge whereby individuals need to know how to succeed in an environment that is not taught and informed directly or in combination of these kinds of thinking. Individuals need to adapt to the environment, shape the environment, and choose the environment, which is one of the aspects of practical thinking skills.

The Development of the Successful Intelligence Interactive Module (SIIM)

According to the Malaysian Education Development 2001–2010, the majority of teachers still use traditional teaching methods and not much ICT in the teaching and learning process (Kapi, Osman, Ramli & Taib, 2017; Ministry of Education Malaysia, 2013). The integration of multimedia elements through ICT in the teaching and learning process enables teachers to introduce contextual learning to the students. The development in multimedia technology promises potential in changing the students' way of learning, acquiring information, and customising the information. Kapi et al. (2017) state that children of the twenty-first century have been exposed to the multimedia world from birth; therefore, they are comfortable with such technologies. Multimedia also provides various prospects for educators to apply various teaching techniques (Kapi et al., 2017). In fact, students were given the opportunity to use various senses in learning. Multimedia components would provide the students with the opportunities to experience a more engaging and effective learning environment. The sources of information and references are no longer limited to textbooks because the presence of multimedia technology has an interactive impact on the learning process. This statement is in line with Emaliana (2017) who states that the traditional mode or form of teacher-centred teaching is no longer effective in meeting the needs of students. Therefore, this study aimed to test the interactive modules that are built on multimedia elements to stimulate thinking skills.

This study incorporated the SIIM which contains problem-solving activities to stimulate UUM students' thinking. This effort is in line with the United Nations Educational, Scientific and Cultural Organization's ([UNESCO], 2010) statement that students can develop problem-solving skills to analyse a problem. SIIM was developed through Adobe Flash Player CS6 software (McDonald, 1999) by incorporating multimedia elements. This module incorporates five multimedia elements: text (text is the foundation for word processing programs and is still the fundamental information used in many multimedia programs), graphics (images such as those in a photograph or drawing), animation (animation refers to moving graphic images), audio (the combination of audio sound into a multimedia application to enhance learning), and video (Stanisavljevic, Nikolic, Tartalja & Milutinovic, 2015). These elements will make the teaching and learning process more interactive as they integrate the students' real-life situation using a computer-based learning approach. According to McDonald (1999) the multimedia elements can improve the students' understanding of the simulated model.

In addition, this module contains four short

videos as tasks to be analysed by the students. Al Rajhi (2016) states that video is one of the elements that can attract the students' attention in learning. The students were required to present their opinions and solutions to the problems that were shown in the short videos. McDonald (1999) conjectures that video clips can present an issue more clearly as they help students to see and hear the situations presented. The use of animation in a presentation presents a more realistic presentation than with the use of text alone (McDonald, 1999). As a result, this study has incorporated the animation elements into the module.

SIIM is an interactive application of computer-based learning. The name of this application is based on the theory of successful intelligence theory introduced by Sternberg (2018). It is built as interactive teaching material that aims to enhance analytical, creative and practical thinking skills among Universiti Utara Malaysia undergraduate students (education programme). SIIM includes various multimedia elements such as video (current social issues in the Malaysian context such as abandoned babies and poverty), text from newspaper clippings, photographs, and animation to stimulate students in solving problems in real life. This interactive module provides learning activities where students need to complete the given tasks. The three types of tasks measure analytical, creative and practical thinking skills. Rubrics were provided to guide students to think and solve problems using analytical, creative and practical thinking. The following is an example of a task for creative thinking. Students were to use recycled items to create new items according to certain themes, such as children's toys. An example of a question that the students were required to answer was, "Based on the video, what lessons have you learnt?" This question involves students to analyse information (produce messages, ideas or views). This application was built in the native language of the Malaysian community, Malay. The rubrics were built based on the successful intelligence theory to solve problems using analytical, creative and practical thinking skills (Azid, Makhsin, Mohktar & Hashim, 2015). The purpose of these rubrics was to help and guide students in solving problems using the three types of thinking skills under study.

Method

In this study we employed a quasi-experimental pre- and post-test design using both quantitative and qualitative approaches (Creswell, 2014; Fraenkel, Wallen & Hyun, 2015). A mixed-method design (sequential explanatory design; phase one: quantitative and phase two: qualitative) was implemented in this study. The purpose was to use the qualitative results to further explain and interpret the findings from the quantitative phase (Creswell, 2014). A group of students was randomly selected

from the mainstream education programme from the School of Education and Modern Languages at the Universiti Utara Malaysia. The students were then randomly divided into two groups (control [$n = 35$] and experimental [$n = 35$]).

In the first week, the control group (X^1) and experimental group (X^2) were given a pre-test from the Sternberg triarchic abilities test (STAT). In weeks two to five, the experimental group (X^2) underwent enrichment activities using SIIM for one month, while the control group learned thinking skills indirectly through application in courses offered in the educational programme. After a month the control and experimental groups sat for a post-test. The data were analysed using the Statistical Package for the Social Sciences (SPSS) version 24. The hypotheses were then analysed using ANCOVA test and Kruskal-Wallis H non-parametric test ANCOVA to compare the mean values of the treatment and control groups for before and after the intervention (Field, 2017). The research instrument, STAT, was used to identify the thinking skill scores of both groups in analytical, creative and practical aspects before and after the intervention. The test consisted of two sections: 1) multiple-choice questions with 36 items; and 2) an essay with an overall score of 90 marks. According to Sternberg (2018) the questions incorporated verbal, quantitative, and figural content. The STAT marking procedure adhered to the marking procedure set by Sternberg (2018) through STAT level H. Level H is the instrument to measure the analytical, creative and practical thinking skills for college and university students.

Essay STAT Marking Scheme

Essay Sternberg triarchic abilities test (STAT) is an instrument introduced by Sternberg (2018). The purpose of this instrument was to measure analytical thinking, creative thinking and practical thinking. It is divided into two sections namely the scoring of multiple-choice questions and the essay questions. The STAT essay contains three types of tasks:

- 1) Discuss the advantages and disadvantages of police deployment or placing more security guards in schools (analytical thinking).
- 2) Think about a problem you have encountered recently. Briefly state the issue, including how long the problem has affected you and the parties involved (if any) and outline three practical ways to resolve the issue.
- 3) Assume that you are a student representative to an authorised committee which has funds to reform the education system. Describe the ideal school system in your opinion, including buildings, teachers, curriculum and other aspects that are important.

Three senior Lecturers in UUM were appointed as STAT essay examiners. After the students had answered the essay questions, the three lecturers reviewed the four sets of essays and the equality of

the raters' scoring was identified to ensure that the three raters gave equal scores without any biased interference. STAT essay assessment was divided

into two aspects: (i) thinking skills, (ii) correct grammar and sentence structure. Details on the evaluation of both aspects are provided in Table 2.

Table 2 Essay STAT marking scheme

Aspect one		
Analytical aspect	Creative aspect	Practical aspect
1) Does the feedback illustrate students' understanding?	1) How innovative is the feedback?	1) Does the feedback portray that students are thinking when writing the responses?
2) Does the feedback address the question?	2) Does it show the ability of the imagination and does the ability of the imagination answer the question?	2) Does the feedback show that students consider the information around them?
3) Does the feedback portray analytical thinking in the writing?	3) Is it specific or just a descriptive story?	3) Is the feedback realistic?
	4) Are the events described in detail or not?	
Aspect two		
	• Correct answer (addresses the question) • In detail • Grammar • Spelling • Legible	

The qualitative data were collected through semi-structured interviews from 10 students randomly selected from the experimental group (Braun, Clarke & Weate, 2016). In the interviews the students shared their experiences on the use of SIIM. Their responses were audio-recorded, transcribed, and thematically analysed to generate the themes to reflect the students' views about the SIIM in general and about the learning activities, assessment, and rubric in particular (Nowell, Norris, White & Moules, 2017).

The Ethical Matters Within the Study

Since the study involved the collection of qualitative data, the following ethical matters were taken into consideration: anonymity, confidentiality, informed consent, researchers' potential impact on the participants, and the participants' impact on the researchers (Sanjari, Bahramnezhad, Fomani, Shoghi & Cheraghi, 2014). A letter, indicating the purpose and significance of the study, was sent to the Dean of the School of Education and Modern Languages (SEML), Universiti Utara Malaysia, who then granted permission to involve undergraduates under the SEML's prerogative. After randomly selecting 70 students from the sampling frame (Creswell, 2014), invitation letters, in which they were requested to attend a meeting at one of the lecture halls at SEML, was distributed to the 70 students. At the meeting we briefed the students on the purpose and significance of the study. The students were made aware of the data collection process, which involved the quantitative and qualitative phases, as well as the fact that only 10 students would be interviewed during the qualitative phase. They were told that their participation was voluntary, and aspects of anonymity were explained (Creswell, 2014; Richards & Schwartz, 2002). The students were also informed that they

could withdraw from participating at any time during the study. They were also briefed on the notions of the dissemination process and clear and honest research reporting without deception to the readers (Arifin, 2018). We informed the participants in writing that they could have access to the data, and we also informed them of the ways in which the data might be used (Creswell, 2014). At the end of the meeting, those who were willing to participate, were given consent forms to sign. All the students signed the forms and were willing to be involved in the study.

Reliability

The reliability values for STAT (multiple-choice) based on *KR20* in this study were: analytical = .67, creative = .62, and practical = .65, which prove that the reliability values for both instruments were applicable. The coefficient values of the STAT test (multiple choice) derived from Sternberg's (1995) study were .63 for analytical thinking skill, .62 for creative thinking skills and .48 for practical thinking skills. The reliability values for the STAT (essay) using Spearman Brown in this study were: analytical = .70, creative = .66, and practical = .65, whereas the essay question results in Sternberg's (1995) study were: analytical = .69, creative = .58 and practical = .68.

Internal Validity

The instruments which were translated into the Malay (mother tongue), and were analysed for face and content validity by six experts (senior university lecturers) from language, psychology, and education. The six experts confirmed that the translated instruments had excellent face and content validity. We maintained the internal validity by administering the post-test two months after the pre-test to produce more convincing results (Campbell &

Stanley, 2015).

Intraclass-correlation Coefficient

A total of five university lecturers (from language, psychology and education) and five secondary school teachers (a group with fifteen years' experience in teaching) were appointed to obtain the credibility of the SIMM ratings prior to using them in this study. A high degree of reliability was found among the raters. The average measure for the intraclass correlation coefficient (ICC) was .87 with a 95% confidence interval from .425 to .996 ($F(2,8) = 18.353, p < .000$), which means that there is an almost perfect agreement among the raters on the following elements of the application: introduction of the content, learning activities, and assessment.

Homogeneity Test

The Levene's test results for analytical thinking skills ($F(1,68) = .196, p > .05$) and practical thinking skills ($F(1,68) = .369, p > .05$) failed to reject the null hypothesis. It showed that there was no variance in the dependent variables for each category of independent variables. The survey data fulfilled the ANCOVA test requirements for testing H_1 and H_2 . However, the Levene's test results for creative thinking skills were $F(1,68) = 10.933$ and $p < .05$ that showed variance in the dependent variables for each category of independent variables. These results have proven that the data failed to comply with the ANCOVA test requirements for testing H_3 . Hence, we conducted the Kruskal-Wallis H test (Piaw, 2014), which is similar to the

Mann-Whitney U test, because the independent variable had two categories.

Results

Result of ANCOVA Test Score for Analytical Thinking Skill

Referring to Table 3, the results of the ANCOVA test show that the independent variable had a significant effect on the dependent variable for the post-test on analytical thinking skills ($F(1,67) = 137.037, p < .05$). In addition, the pre-test control variables had a significant effect on the dependent variable for the post-test on analytical thinking skills ($F(1,67) = 48.168, p < .05$). As a result, we rejected the null hypothesis. The test scores for analytical thinking skills for both the control and experimental groups have proven that the difference between the two pairs of comparison was significant after controlling Type I errors using the Bonferroni method. Both the control and experimental groups achieved significant results (mean difference in post-test analytical thinking skills = 7.3714, $p < .05$).

The results of this analysis confirm that there was a significant effect on the dependent variable of the post-test for analytical thinking skill, after controlling the control variables of the pre-test for analytical thinking skills. The findings suggested that the implementation of enrichment activities through the successful intelligence interactive module had a significant impact on the analytical thinking skills scores among the students in the UUM education programme.

Table 3 Results of ANCOVA analysis for analytical thinking skills

Source	Type III SS	df	MS	F	Significant
Corrected model	1217.155 ^a	2	608.578	110.104	.000
Intercept	510.146	1	510.146	92.295	.000
Pre-test analytical thinking	266.241	1	266.241	48.168	.000
Sample group	757.447	1	757.447	137.037	.000
Error	370.330	67	5.527		
Total	25582.000	70			
Total corrected	1587.486	69			

Note. ^a $R^2 = .767$ (Modified $R^2 = .760$).

Results of ANCOVA Score for Practical Thinking Skills

Referring to Table 4, the results of the ANCOVA test showed that the sample group's independent variables had a significant effect on the dependent variable for the post-test on practical thinking skills ($F(1,67) = 96.954, p < .05$). In addition, the pre-test control variables had a significant effect on the dependent variable for the post-test on practical thinking skill ($F(1,67) = 17.206, p < .05$). As a result, we rejected the null hypothesis. The comparative test results of the practical thinking skill for both the control and experimental groups showed that there was a difference between the two

pairs of comparisons which was significant after controlling Type I errors using the Bonferroni method. Both the experimental and control groups obtained significant results (the difference in the mean of the post-test on practical thinking skill = 7.3715, $p < .05$).

These results confirmed that the independent variables had a major effect on the dependent variable for the post-test after controlling the pre-test on practical thinking skills. The findings suggest that the implementation of enrichment activities through interactive modules had a significant impact on the practical thinking skill scores among the students in the UUM education programme.

Table 4 Results of the ANCOVA analysis for practical thinking

Source	Type III SS	df	MS	F	Significant
Corrected model	1110.635 ^a	2	555.318	59.823	.000
Intercept	592.793	1	592.793	63.860	.000
Pre-test practical thinking	159.721	1	159.721	17.206	.000
Sample group	899.989	1	899.989	96.954	.000
Error	621.936	67	9.283		
Total	24054.000	70			
Total corrected	1732.571	69			

Note. ^a $R^2 = .641$ (Modified $R^2 = .630$).

Results of ANCOVA Score for Creative Thinking Skills
Referring to Table 5, the Kruskal-Wallis H test

results show that there was a significant difference between the two sample groups ($X^2 (1, N = 70) = 35.246, p < .05$).

Table 5 The results of Kruskal-Wallis H (Creative intelligence score)

Test statistics ^{a, b}	
Post-test creative thinking skill score	
X^2	35.246
df	1
Asymp. sig.	.000

Note. ^aKruskal Wallis test. ^bGrouping variable: Group. Asymp. = the p value of X^2 statistic.

Referring to Table 6, the mean score for the control group was 21.13 and for the experimental group, 49.87. These results show an increase and

significant differences in the experimental group's scores.

Table 6 Mean scores for control and experimental groups

	Group	N	M rank
Post-test creative thinking skills	Control	35	21.13
	Experimental	35	49.87
	Total	70	

Analysis of the Interviews

The results of the interview data analysis revealed four themes, namely: (i) the activities challenged the mind in using analytical, creative and practical thinking, (ii) students understood analytical, creative and practical skills after undergoing the successful intelligence interactive module, (iii) successful intelligence interactive module learning activities and rubrics were helpful for students to develop problem-solving skills, and (iv) the integration of technology using computer-based learning approach to attract the students' attention. From an analysis of the interview data, students' perceptions after having used SIIM were as follows.

The activities challenged the mind in using analytical, creative and practical thinking skills

All 10 students (pseudonyms R1 to R10 were allocated for Respondent 1 to Respondent 10) commented that the activities encouraged the use of analytical, creative and practical thinking skills. The activities were challenging and were able to make them find solutions for the problem quickly. The learning activities that incorporated analytical thinking, practicality, and creativity were very exciting and challenging. Comments by several participants are presented below.

This interactive module is challenging to the mind as all the activities required me to use analytical, creative and practical thinking to identify the root cause of a problem and how to solve it. For example, my friends and I used problem identification and comparative and differential skills for analytical thinking skills in the practical and analytical activities. For the practical thinking skills, we used real-life situations or current issues to solve the problems. (R2)

SIIM challenged the mind as all activities encouraged me to use thinking skills to solve the problem. For example, the creative activities required me to design a product based on the theme from the used items (R7).

Yes, all the activities were challenging to me. The activities in the SIIM made me realised that there is a big challenge when we try to apply analytical, creative and practical thinking skills. For example, many activities were based on the current issues that occurred in our everyday life. The video of a baby abandonment and a short story made me read between the lines, which challenged my thinking skills to solve the problem in the assessment. (R9)

Understand analytical, practical, and creative intelligence after undergoing a programme using SIIM

All the interviewed students accurately described the definition of analytical, practical, and creative intelligence using the examples of learning activi-

ties. Some extracts of the participants' interview responses are presented below.

From my understanding, thinking analytically is a way of thinking to identify problems from various aspects to produce effective decisions or solutions. For example, the 'Old shoe' and 'Mother, don't throw us away' activities were among the activities that measured the analytical thinking skills. (R5)

For me, practical thinking is a high-level thinking skill that has tested my skills in solving the daily life problems. My previous experiences in solving my personal everyday issues have helped me in practically solving the problem. Through the use of this thinking skill, I often create, adapt, and choose a good environment for myself. (R7)

After going through the enrichment activities in SIIM, I have a better understanding of creative thinking. Among the components that test creative thinking is creating. For example, we were required to create children's toys from waste materials during the creative thinking activities. The biggest challenge for my friends and I was to think out of the box so that we can produce the desired product with a combination of waste materials. Our first step was to design the children's game on paper to get the initial idea of producing the product. (R10)

SIIM learning activities and rubrics were helpful for students to develop problem solving skills

All of the interviewed students agreed that the SIIM learning activities were beneficial and had a positive effect on them. Furthermore, the rubrics helped them to enhance their problem-solving skills. Some extracts of the interview responses from several participants are presented below.

SIIM's activities were beneficial and had a positive impact on me as it enhanced my thinking skills and helped me solve a problem based on the given rubric (R2).

I felt very happy and enjoyed the SIIM learning activities and it was beneficial to me. For example, I had the opportunity to create new products with my friends during the creative activities. The rubric served as a guide for us to solve the problem. (R3)

Yes, I agree that SIIM benefited us as this programme can help us to improve our thinking and improve our skills to solve problems based on the given rubric which helped us a lot (R6).

The integration of technology using computer-based learning approach to attract the students' attention

The majority of the students agreed that the approach managed to attract their attention. They claimed that the learning atmosphere was more relaxed and enjoyable. Some extracts of the interview responses from several participants are presented below.

I love SIIM because it uses technology integration in learning. Computer-based learning attracted me to solve the problem (R8).

A good effort of the SIIM's construction takes into account the integration of technology using a computer-based learning approach. The learning at-

mosphere is more attractive, relaxed, and not boring even though I have to think for the SIIM (R5).

Discussion

The result of this study could have a powerful impact to several parties, namely the students, lecturers, and higher learning institutions in Malaysia. The results can be regarded as promoting the use of thinking skills in an effort to support the emerging economy resource agenda. Three notions emerged from this study: (i) analytical, creative and practical thinking skills scores among UUM students increased after using the successful intelligences interactive module, (ii) the integration of technology using the interactive module supports students' interest and motivation to participate in analytical, creative and practical learning activities, and (iii) the rubrics in the successful intelligence interactive module helped students develop problem-solving skills using the three types of thinking skills expounded in this study.

The results of the quantitative study show that the analytical thinking skills score (7.3714, $p < .05$) was significantly different between the experimental and control groups undergoing training with the application of indirect thinking skills. The ANCOVA test analysis showed that there was a significant effect on the dependent variable of the post-test for analytical thinking skills after controlling the pre-test among the Universiti Utara Malaysia Education Programme students. As evident from the ANCOVA test analysis, the experimental and control groups also showed significant differences in practical thinking skills (7.3715, $p < .5$). The practical thinking skills sample score was better after learning using the successful intelligence interactive module. This is because the successful intelligence interactive module used in this study provided students with tasks that required of them to solve problems through analytical thinking, creative thinking and practical thinking. The results of the Kruskal-Wallis H test analysis also show that the experimental and control groups showed significant differences in creative thinking skills (χ^2 (1, $N = 70$) = 35.246, $p < .05$), which indicated that the sample creative thinking skills score had improved after learning using the successful intelligence interactive module.

This study showed that the application of analytical, creative thinking and practical thinking skills has contributed to the development of the education programme in UUM. It is hoped that the results of this study would promote awareness and knowledge to all the lecturers of the School of Education and others who are involved in guiding and assisting students in identifying their thinking skills. The results of this study will motivate and provide ideas for lecturers to create and use more problem-solving activities that incorporate analyti-

cal, creative and practical thinking skills. It is envisaged that future teachers, as they progress in their teaching profession, will benefit from this study and become aware of the importance of inculcating the three thinking skills among their primary and secondary school students.

The results of the interview data show that the integration of technology using the interactive module supported students' interest and motivation to participate in analytical, creative and practical learning activities. From this study it was clear that the integration of technology using the interactive module guided and assisted the students in making adjustments in their learning process. Seemingly, the use of the interactive modules had improved the students' analytical, creative and practical thinking skills. Additionally, the carefully designed computer-assisted teaching not only improved the students' knowledge and thinking and changed their attitudes but also helped in developing their cognition. This study provided guidance to the Universiti Utara Malaysia Student Affairs Department and its understanding on the importance of thinking skills as one of the most important soft skills development activities that should be acquired by the university students. However, the results of this study could not be generalised to all university students in Malaysia as the experimental study represented only 70 education programme undergraduates at the Universiti Utara Malaysia. Nevertheless, researchers can regard this study as a sound start to inform universities that analytical, creative and practical thinking skills can be enhanced through tasks that measure these three thinking skills.

Based on the results of this study, we suggest that the construction and design of the curriculum, whether at school or higher institution levels, should pay attention to the elements of thinking. Furthermore, stimulating thinking skills through learning has indeed been an important global educational issue and it is in line with the needs of IR 4.0 that challenges the risk of emerging economies. Hence, higher educational institutions need to ensure that the students who graduate from their institutions are relevant and able to confront the changes in IR 4.0. In a sense, this study supported the need for a public policy for the new generation to confront economic development in line with IR 4.0, which, among others, includes thinking skills to ensure that students are better able to solve problems and make decisions in the future.

Conclusion

In conclusion, through the use of SIIM, UUM students' analytical, practical, and creative thinking skills scores had improved. It is believed that SIIM can help students in improving their academic achievement and nurture them to become highly capable teachers. The learning system in higher

learning institutions is different from the learning system in school, where the learning system is more examination-oriented and uses rote learning, which focuses on memorisation. Sternberg (2018) states that the learning process at the university is interactive and requires the students' mind to be active while listening to the lectures. Students are encouraged to be active participants when attending tutorials, which require them to respond and present their assignments for the purpose of clarifying and expressing their consent or objection. Therefore, students need to change their cognitive approach in learning to enable them to learn effectively in the higher learning institutions. This study has provided the knowledge on the process of high-level thinking in solving everyday problems. The current standards of learning are higher and it is important for university students around the world to be well equipped with adequate knowledge and skills. It is important for teachers to expose the students to effective learning processes using complex materials and applying thinking skills.

Acknowledgement

We wish to thank the Ministry of Higher Education Malaysia for funding this study under the Fundamental Research Grant Scheme (FRGS) S/O code 13582 - <https://doi.org/10.13039/501100003093> - and the Research and Innovation Management Centre, Universiti Utara Malaysia, Kedah for the administration of this study.

Authors' Contributions

Associate Professor Dr Nurulwahida Azid was the lead researcher and she provided the literature review, data collection and data analysis. Associate Professor Dr Ruzlan Md-Ali conducted the interviews with the undergraduate students to obtain qualitative data. All authors reviewed the final manuscript.

Notes

- i. Published under a Creative Commons Attribution Licence.
- ii. DATES: Received: 31 July 2018; Revised: 3 September 2019; Accepted: 27 October 2019; Published: 31 August 2020.

References

- Alawamleh M, Ismail LB, Aqeel D & Alawamleh KJ 2019. The bilateral relationship between human capital investment and innovation in Jordan. *Journal of Innovation and Entrepreneurship*, 8:6. <https://doi.org/10.1186/s13731-019-0101-3>
- Al Rajhi A 2016. Using multimedia presentations in teaching (video, films) in Oman: A cause study of a primary school. *Journal of Teaching and Education*, 05(01):127–136. Available at https://www.researchgate.net/profile/Amaal_Al_Rajhi/publication/303856873_USING_MULTIMEDIA_PRESENTATIONS_IN_TEACHING_VIDEOS_FILMS_IN_OMAN_A_CAUSE_STUDY_OF_A_PRIMARY_SCHOOL/links/5758631108ae9a9c95

- 4a7725/USING-MULTIMEDIA-
PRESENTATIONS-IN-TEACHING-VIDEOS-
FILMS-IN-OMAN-A-CAUSE-STUDY-OF-A-
PRIMARY-SCHOOL.pdf. Accessed 22 June 2020.
- Arifin SRM 2018. Ethical considerations in qualitative study. *International Journal of Care Scholars*, 1(2):30–33.
- Azid N, Makhsin M, Mohktar A & Hashim R 2015. Effectiveness of learning activities using interactive modules successful intelligence. *Australian Journal of Basic and Applied Sciences*, 9(32):1–9.
- Babaei A, Maktabi G, Behrozi N & Atashafroz A 2016. The impact of successful intelligence on students' critical thinking and tolerance of ambiguity [Special issue]. *Journal of Fundamentals of Mental Health*, 18:380–387. Available at http://jfmh.mums.ac.ir/?_action=showPDF&sc=1&article=7780&_ob=4a40556af6ba8577f40940f5ea4bc6e3&fileName=full_text.pdf. Accessed 29 June 2020.
- Bassey MO 2016. Culturally responsive teaching: Implications for educational justice. *Education Sciences*, 6(4):35. <https://doi.org/10.3390/educsci6040035>
- Braun V, Clarke V & Weate P 2016. Using thematic analysis in sport and exercise research. In B Smith & AC Sparkes (eds). *Routledge handbook of qualitative research in sport and exercise*. London, England: Routledge.
- Campbell DT & Stanley JC 2015. Experimental and quasi-experimental design for research. In NL Gage (ed). *Handbook of research on teaching*. Chicago, IL: Ravenio Books.
- Creswell JW 2014. *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed). Thousand Oaks, CA: Sage.
- Department of Basic Education, Republic of South Africa 2017. *Guidelines to strengthen CAPS implementation 2017: Further Education and Training (FET) Band. Grades 10 – 11*. Available at https://www.education.gov.za/Portals/0/Documents/Publications/S1%202017%20Annexure%20B_FET%20Grade%2010%20-%202011_Guidelines%20to%20strengthening_CAPS_Section%204.pdf?ver=2017-03-14-114349-567. Accessed 1 August 2020.
- Department of Statistic Malaysia 2016. *Siaran akhbar perangkaan utama tenaga buruh, Malaysia, Januari 2016* [Press release of the labor statistics, Malaysia, January 2016]. Malaysia: Author. Available at <https://www.dosm.gov.my/v1/index.php?r=column/pdfPrev&id=NEgxdEZab3A2cmUwUjR0ZU4wMmVmQT09>. Accessed 29 June 2020.
- Emaliana I 2017. Teacher-centered or student-centered learning approach to promote learning? *Jurnal Sosial Humaniora*, 10(2):59–70. <https://doi.org/10.12962/j24433527.v10i2.2161>
- Field A 2017. *Discovering statistic using IBM SPSS statistics* (5th ed). London, England: Sage.
- Fraenkel RJ, Wallen EN & Hyun HH 2015. *How to design and evaluate research in education* (9th ed). New York, NY: McGraw-Hill Education.
- Green L, Condry J & Chigona A 2012. Developing the language of thinking within a classroom community of inquiry: Pre-service teachers' experiences. *South African Journal of Education*, 32(3):319–330. <https://doi.org/10.15700/saje.v32n3a583>
- Ismail MH 2012. Kajian mengenai kebolehpasaran siswazah di Malaysia: Tinjauan dari perspektif majikan [Studies on the marketability of graduates in Malaysia: An overview from employers' perspectives]. *Prosiding Perkem VII*, 2(2012):906–913. Available at https://d1wqtxts1xzle7.cloudfront.net/56145686/PROSIDING_PERKEM_VII_JILID_2_Kajian_Majikan.pdf?1521864114=&response-content-disposition=inline%3B+filename%3DKajian_Majikan_Kebolehpasaran_Siswazah.pdf&Expires=1593024402&Signature=hN81NltxtOCa~h5hllTvsaBIntezrXUS3KX7xzvUXlIEWx~5Z8TbgIR3ELt~woOXGhAR5uTzYd-yoCbzQsMEWJMpC2szoLnAPeHthcieeKFv87ey3BrkLdsRimqyO14I700U3KVf6pko0jyluzULD7rFy1SYsApWuC1d7PxYnaOAtyKl7r9iMrIrw~z1Ky rZxC57ZH5wOGeFIS6pMkLKqe1ZEhJ2lfi0Buekf1W3RTjWdQYklaD3OfjNBjc9W0hAJJe9NHR92SNZTqn3kpK~k-kBIBavZFXW6om3IOJbD5ondKzgilTZbh0syIOOIcoT9yvpH4AJtSbEWXsdH9N2Q__&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA. Accessed 24 June 2020.
- Kapi AY, Osman N, Ramli RZ & Taib JM 2017. Multimedia education tools for effective teaching and learning. *Journal of Telecommunication, Electronic and Computer Engineering*, 9(2-8):143–146. Available at <https://pdfs.semanticscholar.org/b971/a8a21975224fb033a1c57c42d43de8cd1a5e.pdf>. Accessed 30 June 2020.
- Kör H, Erbay H, Demir E & Akmeşe OF 2016. Uzaktan ve örgün eğitim öğrencilerinin akademik başarı performanslarını etkileyen faktörlerin araştırılması [A study on the factor affecting the academic performance of distance education students and formal students]. *Hitit Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 9(2):1029–1050.
- Martell CC 2018. Teaching race in U.S. history: Examining culturally relevant pedagogy in a multicultural urban high school. *Journal of Education*, 198(1):63–77. <https://doi.org/10.1177%2F0022057418800938>
- Martz B, Hughes J & Braun F 2017. Creativity and problem-solving: Closing the skills gap. *Journal of Computer Information Systems*, 57(1):39–48. <https://doi.org/10.1080/08874417.2016.1181492>
- McDonald DS 1999. Improved training methods through the use of multimedia technology. *Journal of Computer Information System*, 40(2):14–22.
- Ministry of Education Malaysia 2013. *Malaysia Education Blueprint 2013-2025 (Preschool to post-secondary education)*. Putrajaya, Malaysia: Author. Available at <https://www.moe.gov.my/menimedia/media-cetak/penerbitan/dasar/1207-malaysia-education-blueprint-2013-2025/file>. Accessed 3 July 2020.
- Moodley V 2013. In-service teacher education: Asking questions for higher order thinking in visual literacy. *South African Journal of Education*, 33(2):Art. #430, 18 pages.

- <https://doi.org/10.15700/saje.v33n2a430>
- Nowell LS, Norris JM, White DE & Moules NJ 2017. Thematic analysis: Striving to meet the trustworthiness criteria. *International Journal of Qualitative Methods*, 16(1):1–13. <https://doi.org/10.1177%2F1609406917733847>
- Othman MH 2006. *Kajian tahap kepuasan penawaran bidang pengajian pelajar tahun pertama* [Study on the satisfaction level of programme offered to first year students]. Unpublished research report. George Town, Malaysia: Unit Penasihat dan Pembangunan Pelajar, Universiti Sains Malaysia.
- Patacsil FF & Tablatin CSL 2017. Exploring the importance of soft and hard skills as perceived by IT internship students and industry: A gap analysis. *Journal of Technology and Science Education*, 7(3):347–368. <https://doi.org/10.3926/jotse.271>
- Piaw CY 2014. *Ujian univariate dan multivariate* (Buku 4) [Univariate and multivariate test (Book 4)]. Kuala Lumpur, Malaysia: McGraw-Hill.
- Richards HM & Schwartz LJ 2002. Ethics of qualitative research: Are there special issues for health services research? *Family Practice*, 19(2):135–139. <https://doi.org/10.1093/fampra/19.2.135>
- Sanjari M, Bahramnezhad F, Fomani FK, Shoghi M & Cheraghi MA 2014. Ethical challenges of researchers in qualitative studies: The necessity to develop a specific guideline. *Journal of Medical Ethics and History of Medicine*, 7:14. Available at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4263394/pdf/jmehm-7-14.pdf>. Accessed 30 June 2020.
- Souza M 2017. *What emerging economies can teach us about designing better innovation policies*. Available at <https://www.weforum.org/agenda/2017/01/designing-iinnovation-policies-in-emerging-economies/>. Accessed 24 August 2018.
- Stanisavljevic Z, Nikolic B, Tartalja I & Milutinovic V 2015. A classification of eLearning tools based on the applied multimedia. *Multimedia Tools and Application*, 74:3843–3880. <https://doi.org/10.1007/s11042-013-1802-4>
- Sternberg RJ 1995. *A triarchic approach to giftedness*. Storrs, CT: National Research Center on the Gifted and Talented. Available at <https://files.eric.ed.gov/fulltext/ED429393.pdf>. Accessed 3 July 2020.
- Sternberg RJ 2018. Speculations on the role of successful intelligence in solving contemporary world problems. *Journal of Intelligence*, 6(1):4. <https://doi.org/10.3390/jintelligence6010004>
- Sternberg RJ, Lipka J, Newman T, Wildfeuer S & Grigorenko EL 2016. Triarchically-based instruction and assessment of sixth-grade mathematics in a Yup'ik cultural setting in Alaska. *Gifted and Talented International*, 21(2):9–19. <https://doi.org/10.1080/15332276.2006.11673471>
- UNESCO 2010. *Teaching and learning for a sustainable future – climate change module*. Available at http://www.unesco.org/science/doc/cc/plenaryII/TL_SF_ClaytonWhite.pdf. Accessed 14 June 2020.
- Xu J & Wang B 2018. Intellectual capital, financial performance and companies' sustainable growth: Evidence from the Korean manufacturing industry. *Sustainability*, 10(12):4651. <https://doi.org/10.3390/su10124651>
- Zainuddin Z & Halili SH 2016. Flipped classroom research and trends from different fields of study. *International Review of Research in Open and Distributed Learning*, 17(3):313–340. <https://doi.org/10.19173/irrodl.v17i3.2274>