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Intellectual Discourse
Vol. 28, No. 1, 2020

Contents

Editorial
Ishtiaq Hossain 1

Pathways of Becoming Political Party Activists:
The Experiences From Malay-Muslim Grassroots Party Activists
Wan Rohila A. Ganti Bt. Wan Abdul Ghapar &
Ahmad Fauzi Abdul Hamid 5

Mediation and Interreligious Discourse: Prospects and
Challenges in Resolving Interreligious Skirmishes in Malaysia
Haslina Ibrahim & Ainul Jaria bt. Maidin 35

Examining the Role of 'Ulama in the
Islamization Process of the Malay World
Mohd Noh Abdul Jalil & Mohd Roslan Mohd Nor 61

Role of Judaism, Christianity and Islam
in Promoting Human Values in the Strife-Torn World
Israr Ahmad Khan 77

Mathematics Anxiety and Performance among College Students:
Effectiveness of Systematic Desensitization Treatment
Najihah Akeb-urai, Nor Ba' Yah Abdul Kadir & Rohany Nasir 99

Faith and Practice: Islamic Perspectives on Robert Browning
Rehnuma Bint Anis & Md. Mahmudul Hasan 129

Syariah Criminal Law Enforcement in
Hisbah Framework: Practice In Malaysia
Alias Azhar, Muhammad Hafiz Badarulzaman,
Fidlizan Muhammad & Siti Zamarina Mat Zaib 149

Imperialism, Colonialism and their Contribution to the Formation of Malay and Chinese Ethnicity: An Historical Analysis
Khauthar Ismail 171

Removal of Despotic Political Regime: The Abū Dharr's Legacy and Its Legitimacy
Mohd. Shah Jani & Raudlotul Firdaus binti Fatah Yasin 195

Nigeria's Foreign Policy Goals in Peacekeeping Operations in Africa
Sani Safiyanu, Roy Anthony Rogers, Wan Sharina Ramlah Wan Ahmad & Amin Jaffri 215

Ecological Modernization in Malaysia: A Review of Pakatan Harapan's Manifesto During the 14th General Election Within the Context of Ecological Modernization Framework
Noor Asyhikin Binti Abd Razak & Nor Azlin Binti Tajuddin 241

Education for the Production and Re-Production of Docile Civic Bodies: The Problems of Civic Education in Thailand
Siwach Sripokangkul 261

Revisiting Southeast Asian Civil Islam: Moderate Muslims and Indonesia's Democracy Paradox
M. Khusna Amal 295

Conceptualizing Islamic Ethics for Contemporary Muslim Societies
Fethi B. Jomaa Ahmed 319

Book Reviews
States of Separation. Transfer, Partition, and the Making of the Modern Middle East. By Laura Robson. Berkeley, Calif: University of California Press, 2017, pp. 247. ISBN 9785229215427
Reviewer: *Kaoutar Guediri* 345

Our Constitution. By Shad Saleem Faruqi. Subang Jaya,
Malaysia: Sweet & Maxwell, 2019, pp. 425.
ISBN 9789672187059 (paperback).
Reviewer: *Ramizah Wan Muhammad* 349

Metodologi Penyelidikan Dalam Pendidikan:
Amalan dan Analisis Kajian. By Ghazali Darusalam &
Sufean Hussin. Kuala Lumpur: Penerbit Universiti Malaya, 2019,
pp. 630. ISBN: 978-967-488-009-5.
Reviewer: *Khairil Husaini Bin Jamil* 353

Intellectual Discourse, 28:1 (2020) 99–127

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Mathematics Anxiety and Performance among College Students: Effectiveness of Systematic Desensitization Treatment

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Rohany Nasir[***]

Abstract: This study examines the effectiveness of systematic desensitization treatment on mathematics anxiety and performance among year one college students. This study employs a quasi-experimental research design. The sample for this study is drawn based on convenience sampling. The sample consists of 65 year one students of which 32 are under the experimental group and another 33 are under to control group. The instruments used in collecting data are The Adopt and Adapt Fennama-Sherman Mathematics Attitude Scale (MAS), Neo-Five-Factory Personality Inventory (NEO-FFI), Mathematics Performance Test (MPTs), and The Systematic Desensitization (SD) Module. The study postulates: (1) mathematics anxious students who receive systematic desensitization treatment would report a reduction in the level of mathematics anxiety as compared to those mathematics anxious students who do not receive any treatment; (2) mathematics anxious students who receive systematic desensitization treatment would perform better as compared to those mathematics anxious students who do not receive any treatment. Quantitative data is analysed using ANOVAs. The findings from ANOVAs

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report a significant reduction in the level of mathematics anxiety (F (3, 61) = 16.094, p = .000) and an increase of level of performance (F (3, 61) = 10.806, p = .000) in students who receive treatment. Therefore, the study finds that systematic desensitization treatment has significant desired effect on students' mathematics anxieties and performance.

Keywords: Systematic desensitization treatment, Mathematics anxiety, College students, Personality, Performance.

Abstrak: Kajian ini menguji keberkesanan rawatan desensitisasi sistematik terhadap kebimbangan matematik dan prestasi di kalangan pelajar kolej di tahun satu. Kajian ini menggunakan reka bentuk penyelidikan kuasi eksperimen. Sampel kajian ini menggunakan kaedah persampelan mudah. Sampel terdiri daripada 65 pelajar tahun satu iaitu seramai 32 diletakkan di bawah kumpulan eksperimen dan 33 yang lain di bawah kumpulan kawalan. Instrumen yang digunakan untuk mengumpul data adalah The Adopt and Adapt Fennama-Sherman Mathematics Attitude Scale (MAS), Neo-Five-Factory Personality Inventory (NEO-FFI), Mathematics Performance Test (MPTs), dan The Systematic Desensitization (SD) Module. Hipotesis kajian ini: (1) Pelajar yang mengalami kebimbangan matematik serta menerima rawatan desensitisasi sistematik akan melaporkan pengurangan tahap kebimbangan matematik berbanding pelajar-pelajar yang tidak menerima sebarang rawatan; (2) Pelajar yang mengalami kebimbangan matematik serta menerima rawatan desensitisasi sistematik akan memperolehi prestasi lebih baik berbanding pelajar matematik yang tidak menerima sebarang rawatan. Data kuantitatif dianalisis menggunakan ANOVAs. Penemuan dari ANOVAs melaporkan penurunan yang signifikan dalam tahap kebimbangan matematik (F (3, 61) = 16.094, p = .000) dan peningkatan tahap prestasi (F (3, 61) = 10.806, p = .000) dikalangan pelajar yang menerima rawatan. Oleh itu, kajian mendapati bahawa rawatan desensitisasi sistematik mempunyai kesan yang sangat diingini terhadap kebimbangan matematik dan prestasi matematik pelajar-pelajar.

Kata Kunci: Rawatan sistematik desensitisasi, Kebimbangan matematik, Pelajar kolej, Personaliti, Prestasi.

Introduction

Mathematics is vital to success in school and everyday life. In Malaysia, it is viewed as an important subject and is often considered as one of the indexes of intelligence. The pre-eminence of mathematics in Malaysia is shown in streaming and examination policies. In primary six, students are streamed according to their examination performance

in Mathematics, Science, English and Malay Language. In secondary school level, performing well in mathematics is considered a prerequisite to pursue tertiary levels in science, technology, accountancy, and business (Albert Kienfie, Mustapa & Michael Liau, 2007). For that reason, mathematics continues to be one of the compulsory subjects for all students throughout their primary and secondary educations.

By itself, mathematics has been the major factor that determines the eligibility of students to enter an institution of higher learning. It needs to be reiterated that good grade or good performance in mathematics broadens the choices of course to be studied by the students (Marzita, 2002). In spite of its significance, many people still fear when dealing with numerical information. For example, becoming anxious merely at the thought of taking a mathematics class, feeling nervous just looking at the mathematics textbook, worrying while walking to mathematics class, panic while looking at mathematics questions, shivering at the attempt of mathematics presentation, sweaty palms when answering mathematics questions in front of a crowd, and becoming terrified at the thought of calculus (Nolting, 2000). These examples are basically the description of mathematics anxiety (Siti Huzaifah & Nur Sharidah, 2017).

Mathematics anxiety is refered to as the feeling of tension and anxiety which disturbs the operation or the use of numbers and the solving of mathematical related problems in various situations and learning settings (Richardson & Suinn, 1972; Lindquist, 1981). In other words, it is an irrational fear of mathematics (Lazarus, 1974). Futhermore, it is the utmost reaction to a very negative attitude towards mathematics (Fox 1977). It is also an emotional reaction to mathematics based on a past unpleasant experience, which in turn harms future learning (Freedman 2003).

Mathematics anxiety is divided into two components: emotional and cognitive. The emotional component is characterized by nervousness, tension, dread, fear, and discomfort when doing mathematics (Morris, Davis & Hutchings, 1981). The cognitive component takes account of one's performance, self-doubt, lack of confidence, and negative attitudes (Morris et al. 1981). Individuals who are anxious when facing mathematics-related problems basically tend to exhibit signs of an elevated pulse, nervous stomach, heart palpitations, tension headaches,

upset feelings, and sweaty palms (Adam 2001; Cemen, 1987). Moreover, their minds often go blank to the point that physical symptoms of muscle tightness, diarrhea, shortness of breath, or vomiting are encountered (Arem 2010).

Mathematics anxiety precludes individuals from performing their best, passing fundamental mathematics courses or from pursuing advanced courses in mathematics or science (Lindquist, 1981). An individual with mathematics anxiety interprets his/her anxious feeling as a proof of his/her failure (Bandura, 1997). Furthermore, mathematics anxiety can result in negative consequences such as avoidance of mathematics courses and majors and avoidance of a mathematics-related career (Ashcraft, 2002).

Apparently, Mathematics enjoys a privileged position in the Malaysian education system. In fact, it is the subject that carries a very significant percentage in achievements (Johari & Yeong Wai Chung, 2014). Therefore, the decline in the students' achievements in mathematics requires further attention since mathematics is not only viewed as a subject to be passed in examination, but it is also viewed by Malaysian as passport to gain entrance to the best tertiary institutions (colleges and universities) and to a search for better career and paid jobs. Hence, it is no surprise that parents feel the need for their children to obtain good grade and achieve excellence in mathematics (Marzita, 2002). However, many students experience difficulty in mathematics as it is an exact science and considered to be one of the most difficult subjects (Nolting, 2000).

As a result, the students are exposed to a great amount of burden to achieve well in mathematics and this indirectly seems to produce anxiety in the students (Marzita, 2002). Obviously, if anxiety towards mathematics is not properly treated at the early stage, it would bring about major problems and seriously affect students' lives in the present and in the future (Henslee & Klein, 2017). Such numerical anxiety may later effect the confidence level of students which can ultimately impede their academic abilities and performance. Therefore, there is a need to minimize the opportunity for students to keep these feelings of anxiety which are commonly referred to as "mathematics anxiety". These students need to be introduced to the systematic desensitization treatment to help them overcome their mathematics anxieties.

Ultimately, the students may confidently take higher-level mathematics courses which are useful for career development or employment in a technical area. Importantly, it should be noted that Malaysia aims at becoming a fully developed country with democratic, liberal, tolerant, caring, and progressive values and possessing a competitive and dynamic economy by the year 2020. In order to achieve this vision by 2020, a culture of science and technology needs to be established. Hence, the national development plans have constantly stressed science, mathematics, and technology as the only way to modernization and economize development (Marzita, 2002).

However, suffering from mathematic anxiety, can diminish the students' inclination to attend and succeed in mathematics courses (Stubblefield, 2006). This is most worrisome especially as society becomes more dependent on mathematics literacy. If many Malaysians suffer from mathematics anxiety, Malaysian's vision of becoming a developed country will be impeded. Therefore, introducing a treatment to reduce mathematics anxiety is essential.

Objectives of the study

The main objective of this study is to examine the efficacy of treatment of systematic desensitization in alleviating mathematics anxiety among year one students at the International Islamic College and to examine the effect of systematic desensitization tratment on performance of year one college students with mathematics anxiety.

A number of studies discussed that the systematic desensitization treatment significantly proves to reduce mathematics anxiety and increase performance. Gillingham (1977) reports that systematic desensitization is one of the successful treatment procedures for mathematics anxiety. In this regard, individuals with treatment display the greater reduction in mathematics anxiety level as compared to those individuals with no treatment. Zettle (2003) finds that systematic desensitization and acceptance and commitment therapy (ACT) are significant and equally able to reduce students' mathematics anxieties. Additionally, Higbee and Thomas (1990) find that the combination of the three techniques of systematic desensitization, relaxation technique, and meta cognition prove to have an effect on reducing college students' mathematics anxiety and increasing their confidence levels (self-efficacy). Moreover, Suinn and Richardson (1971) find that there is a

significant and equivalent progress in mathematics anxious university students treated by both traditional systematic desensitization and accelerated massed desensitization (AMD). Both treatments also prove to improve the performance for the treatment groups but not with no-treatment control groups.

The hypotheses of this study are postulated: first, that mathematics anxious students who receive the systematic desensitization treatment would report a reduction in level of mathematics anxiety as compared to those mathematics anxious students who do not receive any treatment, second, that mathematics anxious students who receive the systematic desensitization treatment would perform better as compared to those mathematics anxious students who do not receive any treatment.

Method

Sampling Procedure

This study was conducted with quasi-experimental design study based on the non-equivalent control group (pre-test-post-test non-equivalent control group design). The sample of this study was drawn based on a convenience sampling, a process which involves choosing participants based on their availability or accessibility and willingness to respond (Shaughnessy, Zechmeister, and Zechmeister, 2009). Moreover, its participants are captive audiences such as students or students' teachers (Cohen, Manion, and Morrison, 2011). In this study, the researcher is one of the lecturers at IIC where the research was carried out; therefore, selecting IIC students to be the participants was simply and apparently convenient to the researcher.

Out of 946 year one college students, only 268 claimed themselves as suffering from mathematics anxiety and responded to the poster on the student's notice board advertisement, and classroom announcements of a study of "treatment of mathematics anxiety" and voluntarily signed themselves up for the program during the two-week registration day. A total of 268 mathematics anxious volunteers' year one male and female in the age range of 18-21 years were studying at the International Islamic College in Gombak district of State of Selangor, Malaysia, with different courses enrolled. However, during initial selection day (screening process) only 225 turned up to take part in this study.

Then, 225 participants were required to complete the first set of questionnaires; a Demographic Information, the Adopt and Adapt Fennama-Sherman Mathematics Attitude Scale (MAS), Neo-Five-Factory Personality Inventory (NEO-FFI), and informed consent form for screening purpose. NEO-FFI was specifically used to identify the participants with either high or low in two domains of personality traits: neuroticism and extraversion. In this study, different personality domains of participants identified are regarded as factor which may influence the original difference between the groups as mentioned by Eysenck (1959) that anxiety is fundamental to personality, particularly in the extraversion and neuroticism domains. He further explains that individuals with the neuroticism domain of personality tend to be susceptible towards anxiety-provoking stimulus as compared to those individuals with the extraversion domain (Strongman 1995).

Based on the scoring, out of 225 participants, only 170 experienced mathematics anxiety with a range score of 21 to 60 (inclusion criteria), thus, 55 participants were eliminated from this study due to the score obtained less than 21 which indicated no sign of mathematics anxiety (exclusion criteria). These 170 participants were set for two groups of participants for this study; actual study and pilot study. Out of 170 participants, 30 volunteered to be part of the pilot study specifically for a designed module's reliability and the remaining 140 were for the actual study.

Of 140 participants for the actual study, 105 were females and 35 males. Out of 140, 30 were identified as having high neuroticism and low extraversion and another 110 were categorized as having low in both neuroticism and extraversion. Then, these 140 participants were asked to gather again on the second day for the random assignment process. A total of 140 participants with high neuroticism and low extraversion and low in both neuroticism and extraversion were then randomly assigned to two different groups: experimental and control.

As a result, of 30 participants with high neuroticism and low extraversion, 15 were grouped under the experimental group (experimental group one) and the remaining 15 participants were grouped under the control group (control group one). Similarly, the other 110 participants identified as low in both neuroticism and extraversion was also randomly assigned to two different groups: experimental and

control; 55 participants were in the experimental group (experimental group two) and the remaining 55 participants were in the control group (control group two). Therefore, at the initial stage, the total number of participants in the experimental group was 70 and in the control group was 70. At the end of the session, they were asked to complete a second set of questionnaires of a Demographic Information and Mathematics Performance Test (MPTs) (set 1).

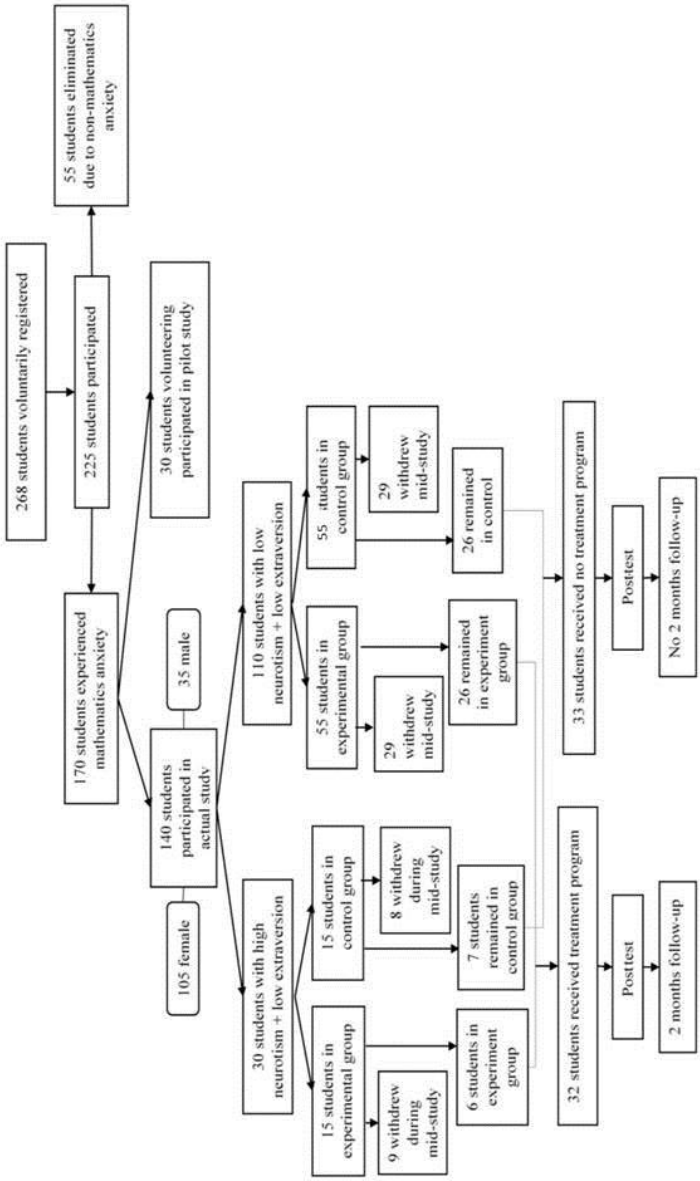
However, only 70 participants who are under the experimental groups receive treatment program designed for over period of six (6) weeks, conversely, the other 70 participants who are under the control group do not receive any treatment program over the same period of six (6) weeks. The 70 participants of the experimental group and 70 of the control group were then given a schedule form to fill up to further divide them into subgroups based on the participants' similar convenient times and preferred days arranged for the treatment program.

Due to the attrition rate, the total number of participants who remained until the end of the actual study for experimental group was 32 (group one and two) and control group was 33 (group one and two). Moreover, the remaining 32 experimental group participants remained in their own groups of similar convenient times and preferred days arranged for the treatment program. The flow chart of population and sample is shown in figure 1

Instruments

Five instruments were used to collect the quantitative data in this study: a Demographic Information, the Adopt and Adapt Fennama-Sherman Mathematics Attitude Scale (MAS), Neo-Five-Factory Personality Inventory (NEO-FFI), Mathematics Performance Tests (MPTs), and The Systematic Desensitization (SD) Module. These instruments were administered at two different times; pre-test and post-test with a Demographic Information as part A for both administrations. However, the Neo-Five-Factory Personality Inventory (NEO-FFI) was only used at a pre-test and the Mathematics Performance Tests (MPTs) were used of different sets at two different administrations (set 1 for pre-test and 2 for post-test). The instruments were administered initially at the pre-test at the beginning of the study before the actual treatment program. This pre-test was performed in order to ensure reliable scores were acquired. Eventually, the post-test was administered after the actual treatment

Figure1: flow chart of population and sample



program ended with the same tests used at the pre-test. Both pre-test and post-test were administered on both the experimental and control groups. The instruments in this study were distributed to the participants in two versions; English and Malay, except the designed treatment (SD) module and the Mathematics Performance Tests (MPTs) were only in English.

Demographic Information

Demographic Information in this study is aimed to gather the participants' personal information. It consists of eight items: age, gender, course of study, semester of study, last mathematics examination attended, result of last mathematics examination attended, father's educational level, and mother's educational level. It was required to be responded by both groups of participants; experimental and control.

The Adopt and Adapt Fennama-Sherman Mathematics Attitude Scale (MAS)

The Adopt and Adapt Fennama-Sherman Mathematics Attitude Scale (MAS) used in this study is constructed based on the original Fennama-Sherman Mathematics Attitude Scale (MAS) developed by Fennama and Sherman in 1976 (Mulhern & Rae 1998). The scale under this study is aimed to assess the participants' mathematics anxiety levels. The original Fennama-Sherman Mathematics Attitude Scale (MAS) consists of nine domains (subscales); The Attitude toward Success in Mathematics Scale (AS), The Mathematics as a Male Domain Scale (MD), The Mother (M)/ Father (F) scale, The Teacher Scale (T), The Confidence in Learning Mathematics Scale (C), The Mathematics Anxiety Scale (A), The Effectance Motivation Scale in Mathematics (E), and The Mathematics Usefulness Scale (U), each with 12 items, and a total of 108 questions (Fennema & Sherman 1976).

It is a five-point Likert-type scale format which was originally designated to measure mathematics anxiety and factors contributing to the attitudes towards learning mathematics (Fennema & Sherman 1976). The Split-half reliability was found by Fennema and Sherman for all nine scales of the MAS ranging from .86 to .93 (Albert Kienfie, Mustapha, & Michael Liau 2007). Additionally, Mulhern and Rae (1998) report high internal consistency of the MAS for all nine scales, ranging from .83 to .96.

However, to make the instrument suitable for this study, the researcher selected only certain domains (subscales) of the Fennama-Sherman Mathematics Attitude Scale (MAS) which relates to the researcher's topic and questions. There are two methods used to determine the validity of the instrument; 1) face and content validity; 2) the pilot study executed on 30 participants from similar type of samples of year one college students with mathematics anxiety. Additionally, changes and modifications were incorporated in the revised version of the instrument. Subsequently, the instrument was adopted and adapted with selected domains from the original Fennama-Sherman Mathematics Attitude Scale (MAS). Moreover, due to the intersection of the domains of the original MAS scales, its items, therefore, can be reduced, collapsed, and utilized individually with certain purposes (Fennema & Sherman 1976; Mulhern & Rae 1998). The selection of certain items and scales done by the researcher, therefore, is considered acceptable.

The domains finally selected for The Adopt and Adapt Fennama-Sherman Mathematics Attitude Scale (MAS) are; (1) Mathematics Anxiety Scale which intends to measure feelings of anxiety, dread, nervousness, and associated bodily symptoms related to doing mathematics; (2) Perception of Parents' Attitudes scale which designs to measure participant's perception of their mother's and father's interest, encouragement, and confidence in participants' ability; (3) Perception of Teachers' Attitudes which designs to measure participant's perception of their teacher's attitudes towards them as learners of mathematics (Wong 1998).

Additionally, it employs a five-point rating Likert response format from (1) Strongly Disagree to (5) Strongly Agree. The total items of the revised scale were originally 30 items: 12 items for the Mathematics Anxiety Scale, 12 items for the Perception of Parents' Attitudes, and 6 items for the Perception of Teachers' Attitudes. However, the test of the reliability of the 30 item scales shows the lower limit of acceptability during test and retest procedures, thus, items deleted was involved to achieve a higher limit of acceptability. Consequently, item number 24 in the scale was deleted and the finalized version of the study scale consists of 29 items. According to Hair, Black, Babin, and Anderson (2014), reliability is measured by the Cronbach's alpha and its range of zero to one, value of .60 to .70 is considered as a lower limit of

acceptability. Meanwhile, the reliability value of .70 to .80 is regarded as high (Kaplan & Saccuzzo 2001). The instrument was administered at pre-test and post-test.

The scoring procedure of the Adapt and Adopt Fennama-Sherman Mathematics Attitude Scale (MAS) specifically for the mathematics anxiety scale sums up the scores obtained from item no. 1 until item no. 12. The score obtained is then categorized under two levels. The scores of 1 to 20 are categorized as no mathematics anxiety while, the scores of 21 to 60 are categorized as mathematics anxiety. However, the participants with no mathematics anxiety were terminated from this study. Unlike the original version of the instrument which was categorized under three levels. The scores of 1 to 20 are categorized as low mathematics anxiety, scores of 21 to 40 as moderate mathematics anxiety, and scores of 41 to 60 were categorized as high mathematics anxiety. Moreover, the score of the perception of their mothers' and father's interest, encouragement, and confidence in their abilities in learning mathematics (parents' attitudes) are obtained from items number 13-23 with a total of 11 items. For the purpose of this study, the scores range from one (1) to fifty-five (55) with scores of one (1) to twenty-seven (27) indicating a negative perception and with scores of twenty-eight (28) to fifty-five (55) indicating a positive perception. Furthermore, the score of the participants' perception of their teacher's interest, encouragement, and confidence towards their abilities in learning mathematics is obtained from items no 24-29 with a number of total items of six. For the purpose of this study, the scores range from one (1) to thirty (30), with scores of one (1) to fifteen (15) indicating a negative perception and with scores of sixteen (16) to thirty (30) indicating a positive perception.

NEO Five-Factor Personality Inventory (NEO-FFI)

The NEO Five-Factor Personality Inventory (NEO-FFI) is employed to measure participants' personality traits specifically neuroticism and extraversion. It is used to substitute the NEO Personality Inventory-R (NEO-PI-R); a measure of five major personality domains and the six facets which consist of 240 items including neuroticism, extraversion, openness, agreeability and conscientiousness (Costa & McCrae 1992). The NEO-FFI was developed to provide a concise measurement of five basic personality factors (Costa & McCrae 1992). It is considered a

simple short version of the NEO Personality Inventory-R (NEO-PI-R) which consists of only 60 items reflecting each trait above-mentioned. Each trait comprises 12 items.

It requires only 15 minutes for the participants to respond to all 60 items, unlike, the NEO-PI-R which requires the participants to spend 40 minutes to answer all 240 items completely. For every item, the participants are required to tick or circle the response on the scale which illustrates their thoughts and perspectives on a five-point Likert response format scale ranging from one (1) Strongly Disagree to five (5) Strongly Agree. More specifically, (1) Strongly Disagree, (2) Disagree, (3) neutral, (4) Agree, (5) Strongly Agree. The scores range from one (1) to sixty (60) with scores of one (1) to forty-four (44) indicating low neuroticism, extraversion, openness, agreeable and conscientiousness personality trait and with the scores of 45 to 60 indicating high neuroticism, extraversion, openness, agreeable and conscientiousness personality trait.

A reverse scoring procedure is also involved in this scale which affects the different numbers of items from each domain of five personality traits, particularly a total of 26 items are reversed. For this particular reverse score items, the scoring on a five-point rating Likert response format ranges from one (1) Strongly Agree to five (5) Strongly Disagree. More specifically, (1) Strongly Agree, (2) Agree, (3) neutral, (4) Disagree, (5) Strongly Disagree. In this study, only neuroticism and extraversion choose by the researcher as a measurement to categorize the participants into similar personality trait groups. Therefore, the total number of items used in the NEO-FFI is 24 and 13 reverse scoring items in total. It was only used at a pre-test.

A very high internal consistency of the NEO-FFI (the 60-item domain version) reported in the manual is found as follows: N= .85, E= .80, O= .68, A= .75, and C=. 83 (Sherry, Hewitt, Flett, Lee-Bannley, & Hall 2007). Additionally, according to Costa and McCrae (1992), the internal consistency of the NEO-FFI ranges from .68 to .86, and the two-week retest reliability found by Robins, Fraley, Robert, and Trzesniewski (2001) is high, ranging from .86 to .90. The NEO-FFI has been translated into many different languages and revealed validity, and used in several different contexts; it is also considered as the most broadly utilized measures of the Five-Factor model (Pytlik Zilling,

Hemenover, & Dienstbier 2002). The reliability of the NEO-FFI in the Malay version is .62 (Abdul Rahman 2009).

Mathematics Performance Tests (MPTs)

The Mathematics Performance Tests (MPTs) are constructed as sets of basic mathematics assessment based on the SPM mathematics outlines. The tests were developed by a college mathematics lecturer, PhD candidate specializing in Mathematics at the International Islamic University, Gombak, Malaysia. She was also one of the panel experts who validated the tests. The test contents were then validated by two other experts from the School of Management, lecturers with at least 5 years of experience in teaching mathematics at the International Islamic College, Gombak. The tests aim to assess the participants' mathematics performance. It covers the four topics: addition, subtraction, multiplication, and division. The items are multiple choice questions and short question and answer. Participants were given an hour to solve a series of 30 increasingly more difficult mathematical problems without using a calculator. For each question in the pre-test, there is a parallel question in the post-test which assesses the same knowledge but with different items. The answer scheme for the mathematics performance tests are basically, one (1) mark is awarded for problem solved correctly for each question and zero (0) mark is awarded for problem solved incorrectly for each question. The level of mathematics performance is determined by the scores from zero (0) to thirty (30) with scores of zero (0) to fifteen (15) considered as low performance and with scores of sixteen (16) to thirty (30) considered as high performance. The reliability of test -retest for MAS, NEO-FFI, and MPTs are shown in table 1.

Table 1: The reliability of test - retest for MAS, NEO-FFI, and MPTs

Instrument	Domain/ Set	Number of items	Cronbach's Alpha	
			Test	Retest
Adopt and Adapt Fennama - Sherman Mathemat-ics Attitude Scale (MAS)		30	0.597	0.618
		29 (item 24 deleted)	0.627	0.647

NEO - FFI	Neuroticism	12	0.651	0.701
	Extraversion	12	0.605	0.665
MPTs	Set 1	30	0.840	0.860
	Set 2	30	0.786	0.806

The Systematic Desensitization (SD) Module

The Systematic Desensitization therapy was deliberately designed by Wolpe in 1958 and is considered as a therapeutic procedure where the counter-conditioning of an anxiety response to a specific set of stimuli are made through repeated pairing of imaginable representations of fear-provoking situations with deep relaxation which result in decreased anxiety response (Zemore, 1975). In other words, it is one of the therapeutic techniques applied to unlearn abnormal behaviors (Cervone & Pervin, 2008). Systematic desensitization therapy takes three steps: 1) relaxation training, 2) development of anxiety hierarchy, and 3) desensitization of anxiety (Cormier & Nurius, 2003).

The designed module in this study is designed and adapted by the researcher based on the work of Wolpe and Lazarus (1966). For the purpose of this study, the researcher modified the module content to accommodate a group setting and typically conducted it on the small groups of six to ten participants who experience very similar mathematic anxieties. The module was validated by a panel of three experts, lecturers with at least 5 years of experience in teaching psychology related field from three different universities; The Department of Psychology Kwantlen Polytechnic University, Canada, The School of Psychology and Human Development, Universiti Kebangsaan Malaysia (UKM), and The School of Applied Psychology Social Work and Policy, University Utara Malaysia (UUM).

At pre-test, 30 out of 170 mathematics anxious participants voluntarily signed up for the pilot study. A two-week group treatment program was conducted by the researcher on the 30 participants identified with mathematics anxiety. On the last day of pilot study, the participants are required to rate the overall effectiveness of the module conducted on a sheet of SD self-rating scale given to them. The sheet

of systematic desensitization self-report rating scale was validated by a panel of experts who had at least 5 years in Psychology related field from The Department of Psychology Kwantlen Polytechnic University, Canada. The scores on the SD self-rating scale were analyzed using SPSS 21.0 to test the reliability of the designed (SD) module. The 30 items of the four desensitization sessions conducted on the participants show a high internal consistency with a Cronbach's Alpha value of .725. Therefore, the module developed by the researcher for this study is considered as a reliable measure to be used in the actual study.

Treatment Procedure

The designed (SD) module consists of ten (10) modules: (1) The initial selection process; (2) The random assignment; (3) A deep muscle relaxation technique; (4) a group desensitization hierarchy; (5, 6, 7, & 8) Group systematic desensitization. The module is implemented in a period of seven (7) weeks. In general, the actual treatment program commences at modules 3 to 8 during week 2 to 6. However, the desensitization of mathematics anxiety-provoking scenes is initiated at module 5 to 8 during weeks 3 to 6. Therefore, a total of six sessions of treatment were applied to the experimental group participants. The detailed summary of the module three to eight are as follows;

Module 3: A Deep Muscle Relaxation Technique

This module demonstrates a deep muscle relaxation technique. The session starts with a detailed explanation of the relaxation technique based on verbal instruction distributed to the experimental group. The session ends up with a mass training of a deep muscle relaxation technique to the groups (group setting).

Module 4: A Group Desensitization Hierarchy

This module focuses on a group desensitization hierarchy construction by the participants with the help of the researcher. The session begins with identifying the mathematics anxiety-provoking stimuli by the experimental group members. Similar anxiety scenes listed by group members are then arranged accordingly from the least to the highest level in a paper prepared and provided by the research assistants. A total of 12 items of similar anxiety scenes is listed by each group of

four groups in total. The session ends with the practice of the relaxation technique learnt in the previous module 3.

Module 5: A Group Systematic Desensitization

This module stresses on the desensitization of mathematics anxious-evoking scenes listed in the hierarchy earlier in module 4. The session begins with the desensitization of the first-three least anxious items arranged and it is simultaneously engaged with a deep relaxation technique. At the end of the session, a gentle reminder is made by the researcher to the participants to practice the relaxation technique learnt at home.

Module 6: A Group Systematic Desensitization

This module stresses on the desensitization of mathematics anxious-evoking scenes listed in the hierarchy earlier in module 4. However, the desensitization in this session is conducted on a higher level of anxiety experienced by the participants. The session starts with the desensitization in the previous session (scene three) and it ends with the desensitization of three-new scenes listed, scene four (4) to six (6). The session again simultaneously involves a deep relaxation technique. At the end of the session, the participants are again reminded by the researcher to practice the relaxation technique at home.

Module 7: A Group Systematic Desensitization

This module focuses on the desensitization of mathematics anxious-evoking scenes listed in the hierarchy earlier in module 4. And again, the desensitization in this session is conducted on a higher level of anxiety experienced by the participants. The session begins with the desensitization of the previous session (scene six) and it ends with the desensitization of three-new scenes listed earlier in scenes seven (7) to nine (9). The session again simultaneously involves a deep relaxation technique. At the end of the session, the participants are again reminded by the researcher to practice the relaxation technique at home.

Module 8: A Group Systematic Desensitization

This module stresses on the desensitization of mathematics anxious-evoking scenes listed in the hierarchy earlier in module 4. However, the desensitization in this session involves the last three-highest levels of anxiety experienced by the participants. The session starts with the

desensitization of previous session (scene nine) and it moves on to the desensitization of the last three-new scenes listed, scene ten (10) to twelve (12). The deep relaxation technique is again simultaneously engaged in this session. At the end of the session, the participants are again reminded by the researcher to practice the relaxation technique at home.

Overall, a total of six sessions of the treatment program was conducted exclusively by the researcher.

Results

A one-way analysis of variance (ANOVA) is performed to examine the effectiveness of treatment in reducing mathematics anxiety level of the students. The dependent variable is the sum amount of post-test mathematics anxiety and the factor; subgroup has four levels: 1 = experiment one, 2 = experiment two, 3 = control one and 4 = control two. The ANOVA result is significant, F (3, 61) = 16.094, p = .000, as shown in table 2.

Table 2: A one-way analysis of variance (ANOVA)

TOTALMAPS

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	496.100	3	165.367	16.094	.000
Within Groups	626.762	61	10.275		
Total	1122.862	64			

Figure 2 shows that there is significant reduction in the means of those mathematics anxious students who receive the systematic desensitization treatment; (experimental one (M = 27.17) and experimental two (M = 28.92) groups) as compared to those mathematics anxious students who do not receive any treatment; (control one (M = 33.71) and control two (M = 34.12). The means are lower in favour of the experimental groups than the control groups. Therefore, the first alternative hypothesis is accepted.

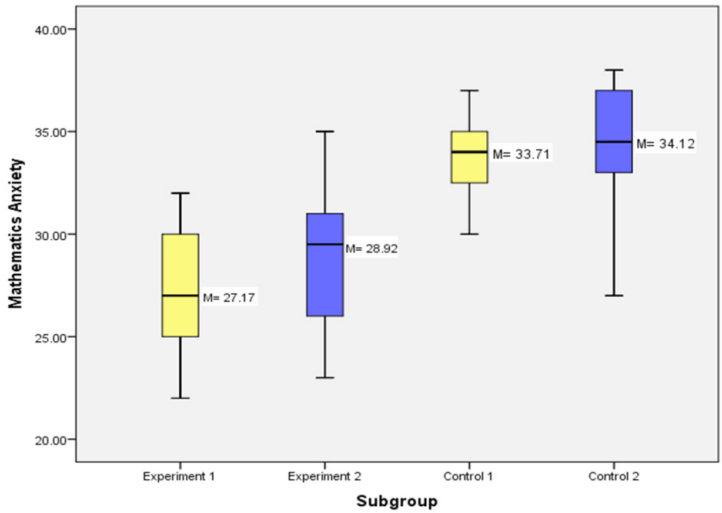


Figure 2

Since Levene's test is not significant, the researcher assumed that the variance is homogenous as shown in Table 3.

Table 3: Test of Homogeneity of Variances

TOTALMAPS

Levene Statistic	df1	df2	Sig.
.622	3	61	.604

Further tests are performed to evaluate pairwise differences among the means scores. Post hoc comparisons using Tukey HSD test (a test which does not assume equal variances among the four groups) is used. As shown in Table 4, there is no significant difference in the means between experimental one and experimental two groups and between control one and control two groups. But there is a significant difference between experimental one and control one groups, and experimental one and control two groups, experimental two and control one, and experimental two and control two groups.

Despite categorizing the participants into subgroups; experimental one, experimental two, control one and control two based on personality domains which are neuroticism and extraversion, the researcher could not find any significant effect of personality on mathematics anxiety in this study.

Table 4: Mathematics Anxiety's Scores According to Subgroup

Subgroup	Mean	SD	Experiment 1	Experiment 2	Control 1	Control 2
Experiment 1	27.17	3.60	-	-5.59 to 2.08	-11.26 to -1.84*	-10.78 to -3.11*
Experiment 2	28.92	3.15	-2.08 to 5.59	-	-8.40 to -1.19*	-7.54 to -2.84*
Control 1	33.71	2.36	1.84 to 11.25*	1.19 to 8.40*	-	-4.01 to 3.20
Control 2	34.12	3.35	3.11 to 10.78*	2.84 to 7.54*	-3.20 to 4.01	-

Note: SD=Standard Deviation, *=The Mean Score is Significant at .05 alpha level

Furthermore, Bonferoni adjustment test is also performed in order to reduce the chances of committing type I error. As shown in table 5, the results found are similar to that of Tukey HSD test.

Table 5: Mathematics Anxiety's Scores According to Subgroup Using Bonferoni Adjustment

Subgroup	Mean	SD	Experiment 1	Experiment 2	Control 1	Control 2
Experiment 1	27.17	3.60	-	-5.72 to 2.20	-11.41 to -1.68*	-10.91 to -2.99*
Experiment 2	28.92	3.15	-2.20 to 5.72	-	-8.51 to -1.07*	-7.62 to -2.77*
Control 1	33.71	2.36	1.68 to 11.41*	1.07 to 8.51*	-	-4.12 to 3.32
Control 2	34.12	3.35	2.99 to 10.91*	2.77 to 7.62*	-3.32 to 4.12	-

Note: SD=Standard Deviation, *=The Mean Score is Significant at .05 alpha level

A one-way analysis of variance (ANOVA) is also conducted to examine whether mathematics anxious students who receive systematic desensitization treatment perform better as compared to those mathematics anxious students who do not receive any systematic desensitization treatment. The dependent variable is the sum amount of post-test Mathematics performance and the factor; subgroup has four levels: 1 = experiment one, 2 = experiment two, 3 = control one and 4 = control two. The ANOVA result is significant, F (3, 61) = 10.806, p = .000 as shown in table 6.

Table 6: A one-way analysis of variance (ANOVA)

TOTALMPPS

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	429.946	3	143.315	10.806	.000
Within Groups	809.038	61	13.263		
Total	1238.985	64			

The researcher assumes variances are homogenous, because Levene's test is not significant as shown in table 7.

Table 7: Test of Homogeneity of Variances

TOTALMPPS

Levene Statistic	df1	df2	Sig.
3.537	3	61	.120

Therefore, further tests are performed to evaluate pairwise differences among the means scores using Tukey HSD. As shown in Table 8, there is no significant difference in the means between experimental one and experimental two groups, between experimental one and control one, between experimental one and control two, and between control one and control two groups. But there is a significant difference between experimental two and control one groups, and experimental two and control two groups. The Bonferoni adjustment test is also computed to

reduce the chance of engaging in the type I error. As reported in Table 9, results are comparable to that of Tukey HSD test.

Table 8: Performance Scores According to Subgroup

Subgroup	Mean	SD	Experiment 1	Experiment 2	Control 1	Control 2
Experiment 1	24.50	2.07	-	-5.70 to 3.01	-1.85 to 8.85	-0.24 to 8.47
Experiment 2	25.85	2.41	-3.01 to 5.70	-	0.75 to 8.94*	2.79 to 8.13*
Control 1	21.00	3.87	-8.85 to 1.85	-8.94 to 0.75*	-	-3.48 to 4.71
Control 2	20.38	4.70	-8.47 to 0.24	-8.13 to 2.79*	-4.71 to 3.48	-

Note: SD=Standard Deviation, *=The Mean Score is Significant at .05 alpha level

Table 9: Performance Scores According to Subgroup Using Bonferoni Adjustment

Subgroup	Mean	SD	Experiment 1	Experiment 2	Control 1	Control 2
Experiment 1	24.50	2.07	-	-5.82 to 3.13	-1.28 to 9.71	-0.36 to 8.59
Experiment 2	25.85	2.41	-3.13 to 5.82	-	1.35 to 9.77 *	2.72 to 8.20 *
Control 1	21.00	3.87	-9.71 to 1.28	-9.77 to -1.35*	-	-4.31 to 4.11
Control 2	20.38	4.70	-8.59 to 0.36	-8.20 to -2.72*	-4.11 to 4.31	-

Note: SD=Standard Deviation, *=The Mean Score is Significant at .05 alpha level

The means values in Table 8 reveal that mathematics anxious student who receive treatment using systematic desensitization; (experimental one (M = 24.50) and experimental two (M = 25.85) groups) perform better than those mathematics anxious students who do not receive any treatment; (control one (M = 21.00) and control two (M= 20.38) groups). The means of the experimental groups are higher than the control groups. This implies that the treatment using systematic desensitization can help mathematics anxious students perform better in their mathematics. Therefore, the second alternative hypothesis is accepted.

Discussion

Though many treatment techniques can ward off mathematics anxiety but the systematic desensitization treatment has been found to be an effective technique. According to Hembree (1990), systematic desensitization therapy was confirmed by past studies to significantly reduce mathematic anxiety and it was also disclosed to be one of the most effective treatments for mathematics anxiety.

The study finding indicates that students who receive the systematic desensitization treatment for mathematics anxiety exhibit a significant reduction in their mathematics anxiety scores and an increase in performance scores as compared to those students who do not receive any treatment. Therefore, the significant difference in the mean scores of mathematics anxiety and performance in the students under study is due to the desired effectiveness of the treatment.

The findings of the study are in agreement with those of Gillingham (1977) and Suinn and Richardson (1971) who conclude that students who receive the systematic desensitization treatment show a significantly low mathematics anxiety level compared to students who had received no treatment. The results of this study, therefore, to the great extent, consolidate the acceptance of the first hypothesis of this study which postulates that mathematics anxious students who receive the systematic desensitization treatment would report a reduction in level of mathematics anxiety as compared to those mathematics anxious students who do not receive any treatment.

With respect to performance, the findings are also in accordance with those of Kington and Coumaravelous (2004), Donner (1970), Berman,

Miller and Massman (1985), and Holroyd (1976) who report that the treatment groups treated with systematic desensitization improve in their performance (GPA). However, the finding does not concur to the findings of Emercy and Krumboltz (1967) and Freeling and Shemberg (1970) who prove that the systematic desensitization treatment fails to improve students' performance. This view despite disagreement, to the some extent, consolidate the acceptance of the second hypothesis of this study which postulates that mathematics anxious students who receive the systematic desensitization treatment would perform better as compared to those mathematics anxious students who do not receive any treatment.

Therefore, it can be said that the systematic desensitization combined with its relaxation technique component, to some extent, produce great effect on reducing the students' mathematics anxiety level and improving their performance. Therefore, it appears to have a therapeutic program within meditational outline which presents the individual with a more general skill by which anxiety may be actively brought down to minimal levels (Goldfried, 1971).

Limitation

There are few limitations in the research. Firstly, the study is confined only to a group of year one mathematics anxious students at a selected college, the International Islamic College (IIC). The findings from this group of samples may not be representative of other students at other colleges and it could not be generalized over the entire mathematics anxious population in Malaysia. Nevertheless, the random assign of the sample under study into two different groups of experimental and control so that the generalization can be applied across the population with the fact that true random sampling is considered as rarely practiced.

Secondly, a small group treatment is broadly applied in this study. Basically, group desensitization is a direct technique application of the individual procedures in a group setting (Shaffer & Galinsky 1974). It was proven to be economical, efficient, and it saved time (Lazarus 1961). In addition, group therapy may provide an opportunity for an enhanced social support (Shaffer & Galinsky 1974). However, the individual procedure permits a greater opportunity to address personal and emotional issues (Wadden & Foster 1992). Nawas, Fishman, and Pucel (1970) mentioned that it is not possible for all group members

to move at the same pace during the treatment process. Therefore, each individual should be provided with a customized desensitization procedure of different amount of exposures, number of sessions, and items of anxiety listed (Nawas et al., 1970). As a result, the effect of treatment produced would be more impactful with the use of individual-based procedure than group-based treatment procedure.

Lastly, the actual study took place towards the middle of the first semester of which students were occupied with the preparation for the midterm examination, quizzes, and assignments. It was also closed to the examination period. This unsuitable timing for treatment conducted would likely affect the level of anxiety among the participants. Consequently, it might have influenced the results of the experiment which affect the reliability and validity related issues as well as affected the attrition rate.

Conclusion

This study examined the effectiveness of systematic desensitization treatment on mathematics anxiety and performance among year one college students. The systematic desensitization treatment has been found to be an effective technique. It has produced desired effectiveness on mathematics anxiety among Malaysian students at the International Islamic College, Malaysia. As a technique, systematic desensitization has shown to improve performance among students as found in this study. It is hoped that this study will benefit the Ministry of Education as it can help to enhance the understanding of how effective is the treatment of systematic desensitization in minimizing the students' anxiety levels.

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In This Issue

Editorial

Articles

Wan Rohila A. Ganti Bt. Wan Abdul Ghapar & Ahmad Fauzi Abdul Hamid
Pathways of Becoming Political Party Activists: The Experiences From Malay-Muslim Grassroots Party Activists

Haslina Ibrahim & Ainul Jaria bt. Maidin
Mediation and Interreligious Discourse: Prospects and Challenges in Resolving Interreligious Skirmishes in Malaysia

Mohd Noh Abdul Jalil & Mohd Roslan Mohd Nor
Examining the Role of 'Ulama in the Islamization Process of the Malay World

Israr Ahmad Khan
Role of Judaism, Christianity and Islam in Promoting Human Values in the Strife-Torn World

Najihah Akeb-urai, Nor Ba' Yah Abdul Kadir & Rohany Nasir
Mathematics Anxiety and Performance among College Students: Effectiveness of Systematic Desensitization Treatment

Rehnuma Bint Anis & Md. Mahmudul Hasan
Faith and Practice: Islamic Perspectives on Robert Browning

Alias Azhar, Muhammad Hafiz Badarulzaman, Fidlizan Muhammad & Siti Zamarina Mat Zaib
Syariah Criminal Law Enforcement in Hisbah Framework: Practice In Malaysia

Khauthar Ismail
Imperialism, Colonialism and their Contribution to the Formation of Malay and Chinese Ethnicity: An Historical Analysis

Mohd. Shah Jani & Raudlotul Firdaus binti Fatah Yasin
Removal of Despotic Political Regime: The Abū Dharr's Legacy and Its Legitimacy

Sani Safiyanu, Roy Anthony Rogers & Wan Sharina Ramlah Wan Ahmad Amin Jaffri
Nigeria's Foreign Policy Goals in Peacekeeping Operations in Africa

Noor Asyhikin Binti Abd Razak & Nor Azlin Binti Tajuddin
Ecological Modernization in Malaysia: A Review of Pakatan Harapan's Manifesto During the 14th General Election Within the Context of Ecological Modernization Framework

Siwach Sripokangkul
Education for the Production and Re-Production of Docile Civic Bodies: The Problems of Civic Education in Thailand

M. Khusna Amal
Revisiting Southeast Asian Civil Islam: Moderate Muslims and Indonesia's Democracy Paradox

Fethi B. Jomaa Ahmed
Conceptualizing Islamic Ethics for Contemporary Muslim Societies

Book Reviews

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2289 5639