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TABLE OF CONTENT

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Technology Exposure, Attitude and Mathematics Achievement: A Structural Equation Model for Comparing Control and Expose Group of Students

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Abstract

A research regarding mathematics performance of students via technology exposure was unraveled through a relation between students' attitude towards mathematics and technology. This approximation of linkage was researched using statistical tests through structural Equation Model (SEM) and Latent Class Analysis (LCA). Hypothetical results of the existing difference between the control group and the exposed were proven through a technic known as an integrated model within the Mplus® software package. The results showed significantly that students from the exposure group have better performance than the control group. Besides that, there was a dramatic improvement of students from less critical courses. Students' priority on mathematics and technology plays an important role as a mediator for background variables and students' mathematics improvement.

Keyword: technology exposure, structural equation modeling, latent class analysis, mathematics achievement

Introduction

A person's ability to translate success based on attitude towards subjects such as mathematics has become a conversation topic of every researcher. Most students choose to aim for better success to actualize the meaning of life as a student (Quaglia & Cobb, 1996). These days, it is a question in every researcher's mind; why is it that the variable of attitude towards subjects especially mathematics has become so important in the performance of a student? It is also said that attitude plays an important role in affecting learning method, direction decision after graduation, increase of motivation in academics and performance in learning (Kharuddin et al., 2019). Roughly, the role of attitude is that great in determining one's future success.

Therefore, can it be concluded that the relation between students' performance can be improved through attitude towards subject that is being learned?

Earlier research has shown that the home and school environment play important roles in attitude development towards a subject (Quaglia, 1996). This research also relates several other latest factors to influence students' attitude towards mathematics especially students at the pre-university level. In the education of mathematics, three important aspects influence the lives of students to guarantee a more excellent life in the future. They are the ability to show a whole interest (Doerr & Zangor, 2000), directness to achieve success (Quaglia & Cobb, 1996) and something new exposure towards students (Allison et al., 2002). In these researches, the three mentioned aspects are referred to as technology exposure, attitude towards mathematics and performance in mathematics (Kharuddin et al., 2017).

The intercorrelations of these three variables in these past researches have been less emphasized. Therefore, the researcher chooses to use the integrated model from the Structural Equation Modelling (SEM) and Latent Class Analysis (LCA) to analyse measurement error sufficiency among the variables besides simultaneously detecting estimation based on students' classification according to attitude and technology. Besides that, the students' background effects are also to be taken into account (Pascarella et al., 1996) in order to control existing direct and indirect effects towards the students' mathematics achievement in the pre-university level (White & Mitchelmore, 1996).

Meanwhile, for the technology exposure variable, a learning aid of the latest technology known as the Graping Calculator (GC) is introduced to a target group. There are two groups involved in the variables and that is the control group and the exposed group. Students in the control group are not formally exposed to the GC utilization. This group will have a traditional approach towards learning where they are only allowed to solved mathematical problems with pen and paper with the aid of a typical scientific calculator. As information, until lately (year 2014), Malaysia's math education allows the use of scientific calculators from middle secondary level up to the higher tertiary education level (Tajudin et al., 2009). On the other hand, the exposure group was generally introduced to the function of graphing calculator beforehand (Kharuddin et al., 2017). They were thought how to interact with the GC in order to solve mathematical problems in this advanced application. Certainly, where are also given a sufficient period of time to get used to the GC application.

Literature Review

The importance of setting performance target was earlier translated and suggested by Lewin & Dembo (1931), where performance level determination, identification of factors affecting the rise and fall and the relation to students' attitude was detailed clearly. Meanwhile, Lewin et al. (1994) proved that attitude itself has a special relation to success achievement besides prevention of failure. Subsequently, research by Sewell & Hauser (1975) in research involving a group of male students from a large and longitudinal sample verified that students' background plays an important role in math performance although the success achievement

ability is constant. Accomplishment or mathematical score can be concluded as a student's achievement capability specifically in the subjects of math.

In the research, the factor of formal exposure to technological aid is also accounted to identify students' capability towards technology in determining their math achievement. Upon obtaining data, students' scores were recorded as continuous and a normality test was done. The obtained data are not normally spread and a standard transformation shall be conducted. Standardized scores are recorded as Standardized Mathematics Achievement with GC-Aided (SMAWGA). Uniquely, this research is placed upon technology exposure factor against math achievement or SMAWGA for science stream students of the pre-university level (Kharuddin et al., 2020). Formal exposure is concentrated on one group alone where theoretically; students whom are given exposure would achieve better math score than students without exposure (Schwalbach & Dosemagen, 2000; Slavin et al., 2009).

However, there are researches proving that technology does not hold the positive effect on students' math achievement (Adya & Kaiser, 2005). This is proven after Adya & Kaiser found that student group especially males having average achievement whilst having an interest in using technology in science and math subjects. Meanwhile, female student group having excellent performance favoured the traditional method of learning, as according to them, technology impedes their minds besides cause the inability to master the real math education as a whole. Generally, students with high and excellent achievements prefer transparent and effective learning, without the so-called distraction and involvement of technology (Krisler & Simundza, 2003). For them, the existence of technology would critically hinder their thinking process and become dependent on the technology and then cause laziness in putting effort (Walker, 2008; Heirdsfield et al., 2008). This student group can be categorized as an anti-group for technology in math. They prioritize only the ability to think quickly without taking into account the capability and disadvantage of others. This group has more concerned about their own success over allowing others (Kharuddin et al., 2020). Furthermore, they are unwilling to give themselves a chance to identify the uniqueness and how advanced the technology can speed up the process of learning deeper math (Boylan & Saxon, 1998; Bendickson, 2004). As a conclusion, there are positive and negative effects with technology exposure in math especially when students' academic background is considered. Therefore, students' attitudes towards math and technology shall be studied and emphasized. This is an approach frequently discussed in the world of math education research. However, many factors could be classified as attitude. Among them are mathematical belief, motivational effort and mathematical self-efficacy (Kharuddin et al., 2017).

One added value to this research is more focus is given towards students' attitude towards GC application in math at the pre-university level. Earlier researches have mentioned several impacts on students' math achievement through the direct effect of attitude towards mathematics (ATM). However, in the latest research by Reznichenko (2007), technology along with positive attitude has a deeper effect on math achievement, especially to less potential student groups. This shows that the role of attitude in math and technology should be hand in order to have a direct effect on students' math achievement especially students

at the foundation level where their future depends fully on their performance in the present level where the next level would be bachelor's degree in the field of their choice and interest.

Research Question

a) Is there an effect of the technology exposure on student's mathematics achievement with GC-aided (SMAWGA), and how is this effect mediated by student's attitude? Does this effect work directly or indirectly?
b) Do the structural equation model (SEM) fitting student's attitude and achievement differ for control and expose group taking into account other student's background variables?

Research Methodology

a) Sampling Technique

This integrated model research is named Experimental Study on Technology in Mathematics, in short ESTIMATH. This research involves 763 students in the foundation level of Centre for Foundation Studies, International Islamic University Malaysia – CFS, IIUM, batch of 2011-2013 representing 2,072 science stream student population. As many as nine subject courses were considered through the stratified sampling technique, developed by Kish (1965) and then reinterpreted by Ross (1987). This institute is a public higher education centre and what is unique is that the students are divided into fixed subject courses. Students are registered according to science courses, in a detailed manner. Hence, it is different from other public matriculation centres where students are generally registered into science courses either health sciences or physical sciences. In this case, students are not given earlier course exposure and would only decide on their bachelor's degree courses after completion of foundation or pre-university level. Is it contrary to CFS, IIUM, where students already have a preference and tendency on a future course and career from an earlier stage in the foundation level? Courses selections in this research are arranged according to priority from 1 to 9 where courses 1-3 are most critical, involving pure science streams such as medicine, dentistry and pharmacy. Meanwhile, 7-9 are physical science stream with less critical courses such as physical science, engineering and ICT. Table 1 illustrates this student crosstabulation sampling in further detail.

Table 1: Crosstabulation of Sample Size by Course Taking, Group of Technology Exposure and Sex Division

Course		Sex		Total
		male	female	
PreMedic	control	10	18	27
	expose	6	18	24
Dentistry	control	6	16	22
	expose	4	8	12
Pharmacy	control	22	40	62
	expose	8	40	48
AllHS	control	20	42	62
	expose	14	40	54
Nursing	control	4	20	24
	expose	0	20	20

BioSc	control	14	38	52
	expose	10	40	50
PhySc	control	8	14	22
	expose	8	16	24
Engine	control	48	46	94
	expose	74	62	136
ICT	control	4	10	14
	expose	4	11	15
Total	control	136	244	379
	expose	128	255	383
		264	499	763

b) Attitude Towards Mathematics (ATM) and Attitude Towards Technology (ATT) Variables

For ATM and ATT tests (Appendix A), there are 60 items or latent variable that are categorically tested using the Likert 5-point scale; starting from 1 – strongly disagree to 5 – strongly agree (Likert, 1932). By using a more detailed questionnaire adapted from Martin Fishben & Icek Ajzen (1980) and Lamb & Fullarton (2001), this research has even more meaning and effectiveness through SEM statistical tests. Analysis for statistical test in this research in whole is using Mplus® 7.0 software (Muthén, 2001; Muthén & Muthén, 2012). The software is suitable for the research as it involves unobservable variables. Theoretically, the attitude variable cannot be studied or formulized using a numerical data collection view (Awodey, 1996). Nevertheless, through latent traits, attitude can be classified into several groups and categories. This approach was tested using a statistical test known as Latent Class Analysis (LCA) to allow the researcher to study the actual attitude of students through math and technology.

c) Technology Exposure Variable

Students from the science stream at the pre-university level were experimented using group comparison technique through technology exposure variable. The students' population list is stratified according to courses and names were selected randomly, divided into two groups which are control group and expose the group. Students of the control group relearned math according to the pre-university's traditional way where the use of learning aid is limited to pencils/pens, papers and scientific calculators. After the 2-hour revision workshop, students were to sit a structural math test and supplied with graphing calculators (GC) each for the entire 1-hour test. Students were also required to indicate by marking how the questioned were answered i.e. via traditional or GC method or also both. For the second group; expose group, students were exposed to interactive GC application. A workshop was conducted to provide optimum exposure to the students on how to solve given mathematical problems aided by GC. All of the students in this group have never used nor experienced GC application before. After the end of the introduction to GC workshop, which lasted for 2 hours, students were supplied with GC emulator software to be installed on their personal computers. Students were then given one week to master the GC application with given exercises. After the end of the exercise, students are called back for a math test of a similar format and questions taken by the control group. This is to test the effectiveness of GC amongst the students and to verify the interpretation of

students' attitudes towards math and technology. Consequently, results of the math tests with GC application, after transformation is recorded as variable SMAWGA.

Analysis and Results

Stage 1: Factor Analysis

This research began with factor analysis allowing 60 latent variables to be analyzed for item elimination. 15 items are from the ATT variable and the remaining 45 items are ATM variables. Table 2 shows the cut-off value for factor loading resulting from the factor analysis elimination test.

Table 2: A simple factor solution by using *Geomin rotation* and a factor *loading cut-off* of 0.3

	AG	FACTOR LOADING	MB	FACTOR LOADING	ME	FACTOR LOADING	MS	FACTOR LOADING
	A1	0.744*	B1	0.248*	E1	-0.119	S1	0.370*
	A2	0.774*	B2	0.490*	E2	0.316*	S2	0.492*
	A3	0.871*	B3	0.549*	E3	0.360*	S3	0.539*
	A4	0.844*	B4	0.388*	E4	0.530*	S4	0.614*
	A5	0.845*	B5	0.364*	E5	0.468*	S5	0.521*
	A6	0.751*	B6	0.341*	E6	0.576*	S6	0.492*
	A7	0.796*	B7	0.348*	E7	0.556*	S7	0.623*
	A8	0.756*	B8	0.344*	E8	0.229*	S8	0.642*
	A9	0.824*	B9	0.243*	E9	0.085*	S9	0.465*
	A10	0.862*	B10	0.319*	E10	0.610*	S10	0.598*
	A11	0.917*	B11	0.300*	E11	0.721*	S11	0.619*
	A12	0.880*	B12	0.123*	E12	0.732*	S12	0.533*
	A13	0.912*	B13	0.392*	E13	0.576*	S13	0.496*
	A14	0.795*	B14	0.315*	E14	0.271*	S14	0.445*
	A15	0.829*	B15	0.156*	E15	0.623*	S15	0.241*
χ^2	1090.428		1090.428		960.265		1697.063	
P-value	0.000		0.000		0.000		0.000	
RMSEA	0.121		0.121		0.113		0.153	
P-value	0.000		0.000		0.000		0.000	
CFI	0.368		0.368		0.775		0.648	
TLI	0.263		0.263		0.737		0.589	

Load factor values more than 0.3 are selected for the next level statistical test (Yates, 1987). Item combination formed through load value are considered as factors and interpreted as follows:

a) Students' attitude towards GC application has 15 items with load value between 0.744 and 0.917.
b) Belief towards math has 11 items with load value between 0.300 and 0.549.
c) Motivational effort has 11 items with load value between 0.316 and 0.732.

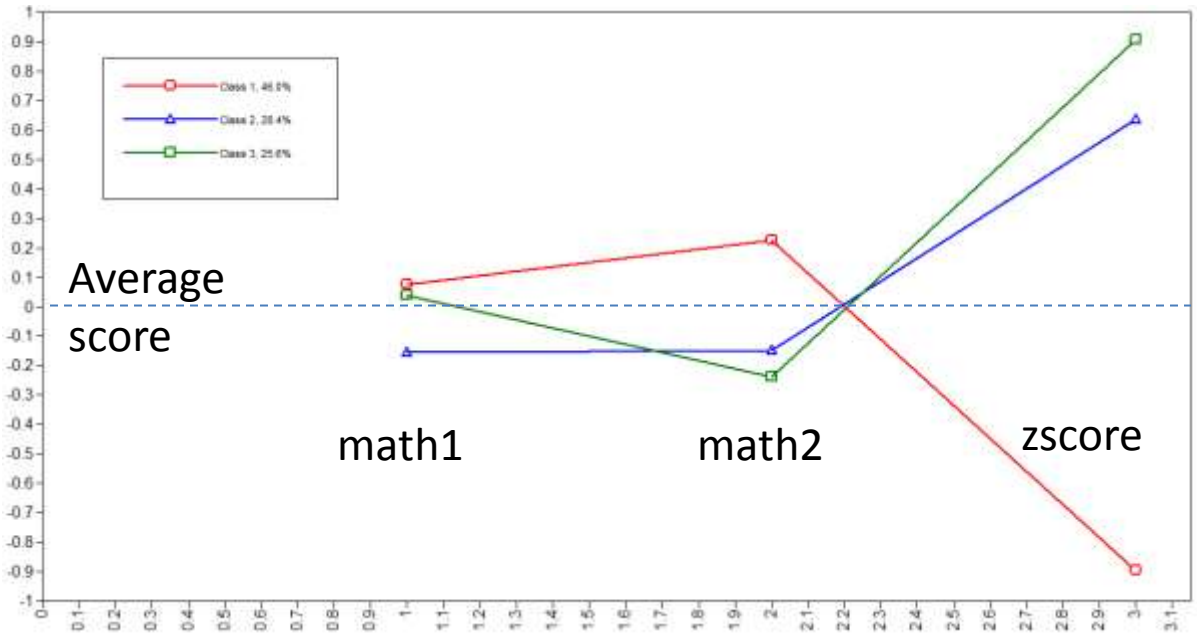
d) Mathematics self-efficacy has 14 items with load value between 0.370 and 0.642.

The source for the above analysis is taken from a study performed by Martin et al. (2003), Koutsoulis & Cambell (2001) and Papanastasiou (2002). By results, 51 items were generated using the Geomin rotation from whole ATM and ATT variable with accurate factor loading value for second stage analysis i.e. latent class analysis (LCA). Then, at the second stage, LCA is divided into two models namely LCA for ATT (Stage 2a) and LCA for ATM (Stage 2b). Both models shall be combined into one structural equation model – SEM (Stage 3).

Stage 2a): Three Models of Latent Class (LC) for Attitude towards Technology (ATT)

In this stage, 15 items from the variable of attitude towards GC application are used to estimate the latent class model value. Based on the significant value (p = 0.0008) against the Log-likelihood ratio chi-square (LL), therein exists a difference between classes to allow the formation of the 3 latent classes. Besides that, the consistency of likelihood ratio via the Lo-Mendell-Rubin Likelihood Ratio Test (LMRLRT) approach also supports the choice of these 3 categories. Additionally, this test also enhances the minimum value for Bayesian Information Criterion (BIC) and Akaike Information Criterion (AIC) besides the stable value of adjusted BIC (aBIC) to differentiate students' attitude towards GC application in math (Hagenaars and McCutcheon, 2002).

Figure 1: ATT Item Probabilities of Math Achievement on Three Performances



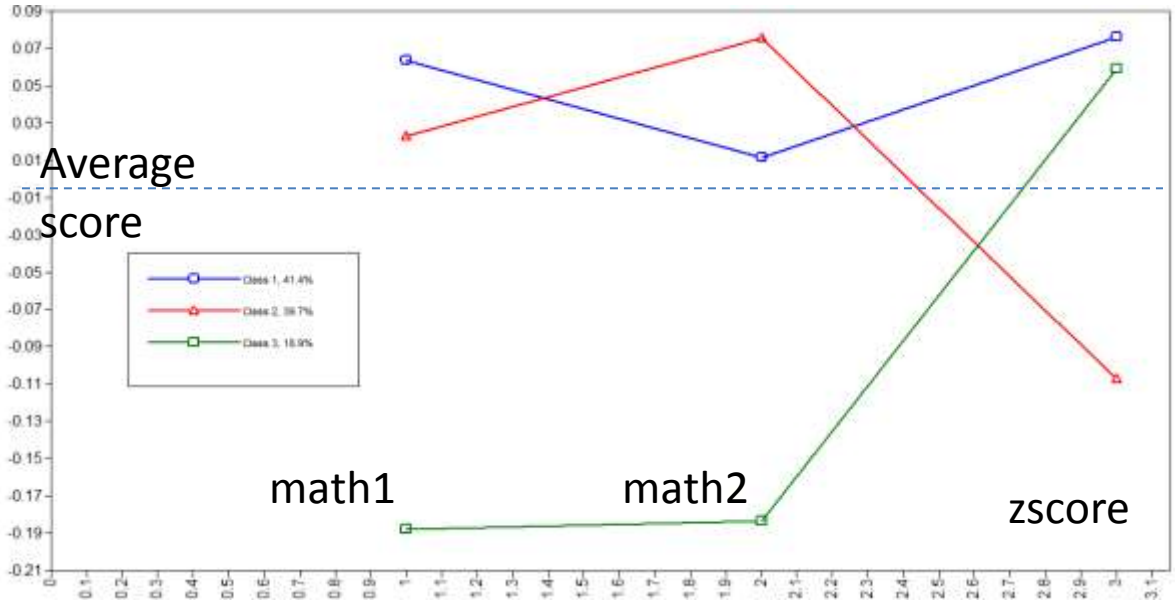
The first class formed from the generation of 3 latent classes is categorized as having a positive attitude towards GC application in math. Most statements were given by 369 (48.3%) students from this category were encouraging and totally agree with ever statement, to the extent that none even one gave a negative statement (disagree). The second class represented by 260 (34.1%) students is placed under ambivalent group due to their inconsistent attitude towards the capability of GC application in math. The remaining 134

(17.6%) students state their stand as uncertain and they are categorized as mainstream attitude and as the third class (Bruin, 2012). These can be expressed in Figure 1 describing students' math achievement according to the resulting latent class.

Stage 2b): Three Models of Latent Class (LC) for Atittude towards Mathematics (ATM)

Contrary to the ATT variable, ATM variable showcases three main components in the latent variable namely, belief, effort and self-efficacy. Supplied with 36 items remaining from the last elimination process (stage 1) the three models of the latent class are formed based on the significant p = 0.0.0180 to prove the existence of differences among classes. This result is supported with LL, LMRLRT value that is consistent with high entropy value (0.977). With no account for latest technology element in mathematics education, the classification of attitude towards math is concluded as class 1 – consistent attitude, class 2 – traditional attitude and class 3 – prepared attitude to improvise. This can be proven via LCA test where it is simplified in Figure 2. The difference between math achievement before and after the test is shown as students' actual attitude towards math based on the formation of latent class. Next, in terms of classification of attitude towards mathematics, the earlier weaker student group (class 3) have put the effort in improving their performance so much so that they surpassed the performance of the student group of class 2 and this is after the introduction of GC. Figure 2 also, shows encouraging achievement improvement for class 3 although having priorly poor achievement. Unfortunately, the contrary happened to the student group in class 2, where SMAWGA performance was not good and disappointing.

Figure 2: ATM Item Probabilities of Math Achievement on Three Performances

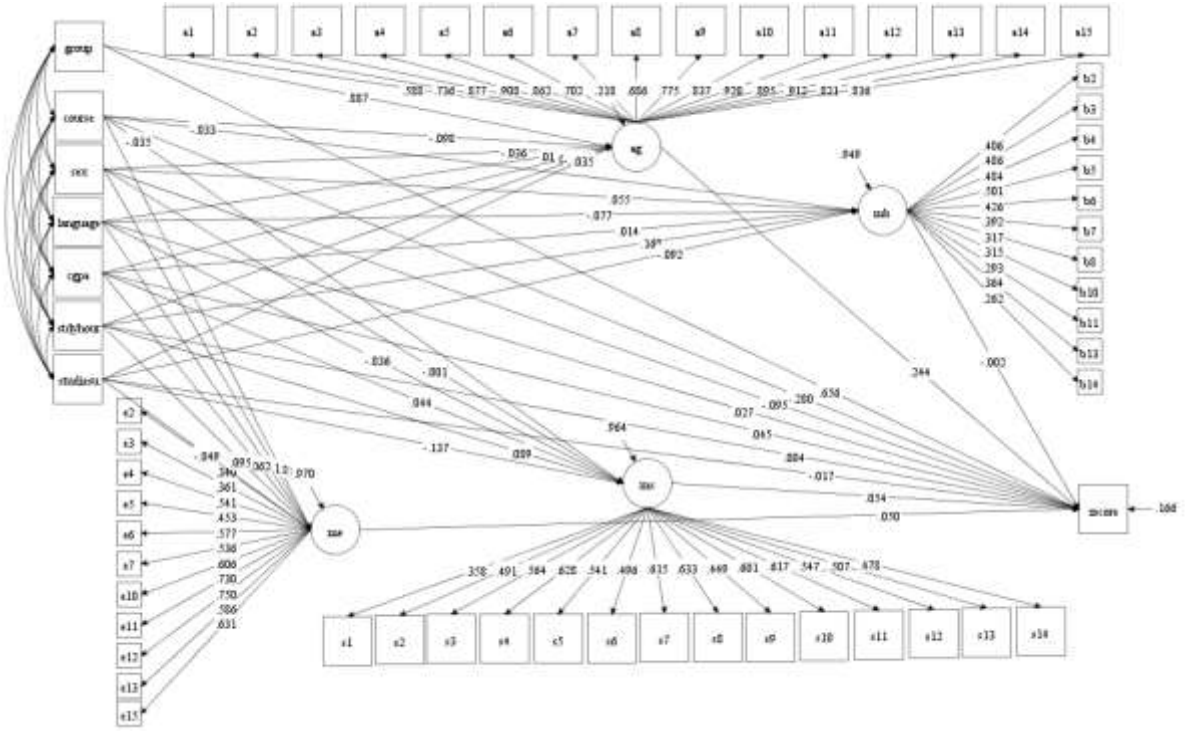


Level 3: Structural Equation Modelling (SEM)

For the measurement of variable intercorrelation, a total SEM test should be considered. This is seen via test in Figure 3 where shows fit indexes occurring in the model. With a significant χ^2 = 45378.562 value (p =

0.000) proves that the fitting probability model for this population is a good fit. With the Comparative Fit Index, CFI = 0.189 and Tucker Lewis Index, TLI = 0.061, it sufficiently supports that the SEM fits well enough. Additionally, the Root Mean Square of Error Approximation (RMSEA) is also a determining indicator for a good fit model. Even without the consideration of sample count, this model is measured as the best estimation with significant values of RMSEA = 0.089 and p = 0.000. With RMSEA value less than 0.10, this model is seen as best in proving the close and strong intercorrelation among variables. Based on the SEM results, the intercorrelation of variable SMAWGA consequented by attitude towards GC (0.244) is the strongest compared to mathematical belief (-0.03), effort (0.05) and self-efficacy (0.054) which have weak intercorrelation. This strong intercorrelation that is seen as strong is also influenced by technology exposure conducted before attitude evaluation. This is proven through a causal relationship at 0.887 between technology exposure (TE) and attitude towards GC. Furthermore, strong, significant and direct intercorrelation is also proven between TE and SMAWGA that is at 0.656. This proves that students exposed to technology, specifically GC will obtain encouraging results in math tests and would for once dodge the assumption that technology in math education is a burden to students.

Figure 3: The Standardized Regression Coefficients for the Relationship between SB (student's background), group (technology exposure) and GC (Math Score with GC Aided) as Mediated by AG (Attitude towards GC), MB (Mathematical Belief), ME (Motivational Effort) and MS (Math Self-efficacy)



For obtaining a fitting comparison model via SEM amongst groups in the technology exposure (TE) variable, the integrated model technique is used to test the invariant covariance matrices and structural relation (Barrett, 2007) via LCA direct effect. At the same time, the course variable displays strong and direct positive

intercorrelation with students' achievement i.e. 0.280. This indicates that students in less critical courses are capable of outstanding achievements in mathematics when assisted with GC application.

Discussion and Conclusion

In the presentation of testing done by Quaglia & Cobbs (1996), the number of factors affecting students performance is referred. This is because students' attitude towards technology and mathematics are two different components. Students tend to obtain encouraging results if they have several positive attitudes within them. This is proven with the strong intercorrelation between TE and SMAWGA whether directly or mediatorly (attitude towards GC). Also, through this technology exposure, students exposed to GC application tend to gain outstanding results in math test SMAWGA regardless of their past performances. This is proven with the dramatic achievement of science students in the less critical courses. As it is, science students in the critical courses have been known to have consistent achievements in all subjects including mathematics. Nevertheless, despite the inclusion of technology such as GC in math education, it is not a hindrance at all for them to maintain such tremendous achievement. With advanced technological learning aid such as the GC, it can help students of less critical courses in improving their performance in mathematics education. Most importantly is that it can change one's attitude and perception towards mathematics and technology where these were considered as difficult and gaining excellent results was impossible. Therefore, for groups categorized earlier as anti for technology in math, they were able to change their perception that not all technology has negative effects. It depends on the condition, time and students' attitude in handling the advanced technological learning aid. It is hoped that in the future, researches in mathematics education will be more focused on the method and ways to maintain students' positive attitude towards mathematics so that excellent achievement can carry on up to graduation.

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Does Fisheries Co-management Work in Malaysia?

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ABSTRACT

The top-down centralized management has failed to provide equitable access to fishing and unfair distribution of benefits towards the poor fishing community in Asia. Community-based management and co-management of fisheries have been implemented in several countries in Asia over the decades. Management models have been developed based on the partnership between governmental organizations (GO), NGOs and fishing communities. This paper discusses the different approaches of the community-based models and how the local community-based institutions have participated for better management of fisheries resources. The paper also discusses the role of partner organizations and fishing communities for effective community-based management of fisheries in Asia. The paper discusses the policy issues of regulatory framework and governance of fisheries in Malaysia. The paper concludes that inequitable access to fisheries, restricted fishing activities are the major policy issues that need to be considered for successful community-based management in Malaysia.

1. Introduction

The large over-exploitation of marine fisheries in many countries has drawn the attention of policymakers over the last decades. Fisheries managers and governments have been struggling with how to manage fisheries where one-third of fish stocks are overexploited worldwide yet more than one billion people depend on seafood as their primary source of protein (FAO 2009 and Worm et al 2009). In the Asian developing countries alone, almost 65 percent of the world's fishers are categorized as the poorest of the poor, continue to depend on fish for food and livelihood survival.

Fish productivity has been reduced due to increased fishing pressure in the Southeast Asian region. Over the past 40 years, standing fish stocks in South-East Asia have been reduced to less than a fourth of their former levels (Pauly *et al.* 2002, Pauly *et al.* 2005). The current fisheries crises pose threat to sustainable fisheries and livelihoods.

Various regulatory tools have experimented which encompasses a wide range of conservation-based management measures to protect the resource and improve economic efficiency (Scott 1979; Beddington & Rettig 1984). In many countries, the government has enacted new laws and expanded to increase their monitoring, control and surveillance capacity. However, most of the efforts have failed to achieve effective governance and sustainable exploitation of resources. In tropical, small-scale, multi-species fisheries, the concept of state management was faced with

enormous implementation and enforcement difficulties where resource access and income distribution are major obstacles to sustainable development. The failure of centralized authorities in managing such resources has been recognized and delegation of management of small-scale fisheries to the local resource users is now seen to be the only rational way of obtaining effective governance. Metzner (2008) highlighted that there are many examples of limited access fisheries where the stocks have been overfished, over capacitated, and unprofitable. Limiting participation in fisheries and catch is not the solution; there is a need to have a sharing mechanism that determines the equitable distribution of benefits.

The government of Malaysia has been working to attain sustainable use of fisheries and to improve the socio-economic conditions of small-scale fishing communities. There is a growing recognition that AR and MPA play potentially effective management tools in sustaining coastal fisheries in several countries. Various regulatory measures have been implemented in fisheries, however, the government has failed to reduce excess fishing capacity in coastal marine waters. The centralized fisheries management system provides limited scope for sustainable and equitable fisheries management in Malaysia.

Community-based co-management has been implemented in inland riverine fisheries in Sabah, east of Malaysia. Another co-management pilot experimental project has been implemented in Kedah state of Peninsular Malaysia. In Malaysia, the government has implemented AR and MPA programs in several coastal areas for more than thirty years. Yahaya (1994) highlighted the experiences of various participatory institutional arrangements in artificial reefs and fish aggregating devices in Malaysia. The characteristics of community-based institutions are different due to heterogeneous fishing communities and local circumstances. However, the co-management programs are at different stages of progress and they are still progressing.

This paper summarizes the experiences of participatory co-management approaches in Malaysia. The objective of the study was to describe the existing community based participatory management approach being implemented in various locations in Malaysia, to assess the potential evolution of fisheries co-management based on the existing community-based programs in artificial reef locations in marine fisheries, and, to recommend the community-based model in marine resources in Malaysia.

2. Malaysian marine capture fisheries

With a coastline of around 4,810 km and an Exclusive Economic Zone (EEZ) of 418,000 km^2 the economic potential of the marine fisheries is enormous in Malaysia. The sector is an important source of employment and income for more than 150 thousand people (Department of Fisheries, DOF, 2010). Fish is a source of animal protein with a per capita consumption of about 45.1 kg in 2009 (Ministry of Agriculture and Agro-Based Industry, MOA 2010). The value-added of the primary fishery sector represents 11% of agricultural GDP and 1.3% of national GDP with a positive balance of trade of RM 601 mil. Marine capture fisheries account for about 75 percent of total fish production in Malaysia (Department of Fisheries, DOF, 2009).

Studies found that fishing vessels operated in all fishing zones have reached close to the full technical efficiency and capacity utilization. Abu Talib et al. (2003) found that the demersal species are already overexploited and the level of fishing effort is beyond that needed for maximum sustainable yield. The continuous depletion of resource stocks is threatening the fisheries in Malaysia. The fisheries industry in Malaysia can be divided into marine fisheries, aquaculture, public water bodies and inland fisheries. Geographically separated by the South China Sea, Malaysia is divided into two regions: Peninsular Malaysia – which lies south of Thailand, and East Malaysia – which lies north of Indonesia on the island of Borneo.

The fishing fleets of Malaysia can be generally categorized into commercial fleets and traditional fleets. The commercial fleets consisting mainly of vessels operating trawls and purse seine gears, while traditional fleets operate traditional gears such as drift/gill nets, hook and lines, traps, bag nets etc. The commercial fleets can be further classified by tonnage classes. Various tonnage classes

specified in the Annual Fisheries Statistics are: (1) less than 25 gross tonnage, (2) between 25 and 39.9 gross tonnage, (3) between 40 to 70 gross tonnage, and (4) greater than 70 gross tonnage. In Malaysia, the marine fisheries resources have declined considerably over the past decade primarily due to overfishing particularly by using trawls. Commercial fishing gears, i.e. trawl nets and fish purse seines are prohibited from fishing in Zone A (0-5 nautical miles) to reduce fishing effort.

2.1 Fisheries Regulatory Framework

Malaysia employs a zoning system in fisheries where water areas are divided into fishing zones based on the distance from the coastline. In peninsular Malaysia, Zone A is less than 5 nautical miles from shore, Zone B is 5 to 12 nautical miles, Zone C is 12 to 30 nautical miles and Zone C2 is more than 30 miles. Under this system use of commercial gears, i.e. trawl nets and fish purse seines are prohibited in Zone A, this area is reserved for the artisanal fishers using traditional fishing gears. Licensing of fishers, vessels and fishing gear were introduced with strict terms and conditions for reducing fishing effort. In addition to the zoning arrangement and license limitation, mesh size regulations for the cod end of trawl nets were extended from 1 inch to 1.5 inches and beam trawlers were prohibited. In order to limit overexploitation, a policy for conservation with a moratorium has been implemented. However, the issue of additional licenses for trawlers within 12 miles was frozen.

The main reason for the overexploitation of fisheries resources is due to its open access characteristics in Malaysia. However, overfishing is not only occurring due to open access of the resources, but also through the encroachment of trawling in the traditional fishing grounds. The main purpose of establishing artificial reefs is to protect marine habitats from trawls and to compensate for the effects of stock depletion. The DOF has developed strong and heavy ARs for this purpose. The DOF does not allow fishing surrounding AR areas to enhance fisheries' resources. Fishing rights are determined by the license provided by the DOF. The Fisheries Development Authority's mandate is to upgrade the socio-economic status of the fishermen community, and as such has policies to:

- promote and develop efficient and effective management of fishery resources and fish marketing;
- create and provide credit facilities for fish production;
- engage in fishery enterprise through boat construction, and the production and supply of fishing gears and equipment;
- promote, facilitate and undertake economic and social development of the Fishermen's Associations;
- register, control and supervise Fishermen's Associations and Fisheries Cooperatives; and
- co-ordinate the implementation of various fisheries activities.

3. Development of Artificial reefs and Fish Aggregating Devices in Malaysia

There is a growing recognition that artificial reefs play a potentially effective role in sustaining coastal fisheries in several countries. It is also acknowledged that although artificial reefs can be a tool for "fisheries development," their functioning as a tool for "fisheries management" is difficult (Meier et al., 1989; Polovina, 1991; Grossman et al., 1997; Pickering and Whitmarsh, 1997). In Malaysia, the traditional small-scale fish aggregating devices FADs or artificial reefs ARs is an age-old practice among the purse seine fishermen since the early 1990s (Yahaya, 1994). Fishers usually used coconut fronds weighted with rocks or cement to attract and aggregate the fish, thus increase the catch. Various management approaches exist in artificial reef locations such as private management, centralized management and co-management.

The Department of Fisheries, Malaysia (DOFM) and the Fisheries Development Authority of Malaysia (FDAM) have been involved in the artificial reefs program since 1975. The ARs (known as "*tukun tiruan*") deployed by the Department of Fisheries Malaysia aims at promoting resource conservation, while the Fisheries Development Authority Malaysia (LKIM) deployed the Fish

Aggregating Devices (known as *unjam*) to enable artisanal fishers to secure access to fish around the structures.

The government has undertaken a massive ARs development program over the past 35 years, 1975-2010 and a total RM 49 million has been spent for these programs. The materials used range from scrap tyres, tree trunks, and derelict boats to modem highly sophisticated pyramidal or cuboid structures made of concrete (Yahaya, 1994). Since 1986, various concrete materials have been used for ARs and FADs, including concrete, reef balls, PVC, ceramics, abandoned oil rigs, and cuboids of various shapes and designs. These structures have been designed to aggregate demersal fish and pelagic fish (Azni, 2008). Artificial reefs serve a variety of functions, ranging from the traditional practice of fish production and aggregation to mariculture, tourism and resource conservation (Seaman, 2002). The main purpose of FAD or *unjam* was to use it as fish sanctuary in marine fisheries, provide user rights to the fishers to fish surrounding *unjam*, to encourage various business activities to support fishing and local tourism.

The Department of Fisheries Malaysia deployed several large AR structures including concrete cubes, cuboids, soft bottom, lobsters, and tetrapod in recent years. The main justification for deploying these durable structures was to protect inshore fisheries from trawls as well as increase the productivity of fish (DOF, 1985).

The Fisheries Development Authority (FDAM) deployed ARs over 550 locations throughout Malaysia until 2010 (Azmi and Yazid 2008). However, several hundred units of fish aggregating devices have been deployed by private individuals and fisher groups in different locations in coastal areas in Malaysia over this period. However, the FDAM received relatively more funding from the government compared to the DOF for the artificial reefs programs.

4. Co-management and Fisheries

Community-based co-management (CBCM) is a people-centered, community-oriented, resources-based partnership approach in which government agencies, the community of local resource users, nongovernment organizations, and other stakeholders share the responsibility and decision making authority for the management of a fishery (Kuperan *et al*., 2003; Berkes et al., 2001; Pomeroy, 2001; Pomeroy and Williams, 1994; Sen and Nielsen, 1996; Nik Mustapha *et. al,* 1998). The idea of fisheries co-management is that communities and the state should work together to manage fisheries and such cooperation will lead to more effective governance of the resource by the people dependent on the resource. This involves the fishers and the resource managers working together to improve the regulatory process for governing the resource.

CBFM is a process that moves towards a substantial role for fishers in management of the resources they depend on within a framework of government support for that process.

There is a hierarchy of co-management arrangements where the fishers are merely consulted initially by the government, but later on, when regulations are introduced fishers are involved in designing, implementing, and enforcing laws and regulations with advice and assistance from the government. Berkes et al. (1991) argued that a more precise definition is probably inappropriate, for there is in practice a continuum of co-management arrangements, similar to the view of 'ladder of citizen participation' showing the degree to which citizens share power in government decision making (Arnstein, 1969; Berkes, 1994).

The ultimate goal for co-management is to empower fishers in the expectation of better management (Viswanathan et al. 2003). Local institutions are important prerequisites for effective co-management because they are to make decisions and undertake collective actions (Kalikoski et al., 2002; Noble, 2000). Top-down legislative changes which focused on regulation and enforcement to control fishing efforts has failed to prevent over-exploitation of fisheries resources. Pomeroy and Viswanathan (2003) pointed out that most of the coastal and inland fisheries in Asia are still over-fished. It is argued that the failure is because this form of management is very much still a centralized top-down approach, focusing on objectives relating to fish resources and based exclusively on formal biological science (Viswanathan et al. 2003) and mostly disregards the

experiences of fishers (Dengbol 2003). As a result, the modern laws and regulations that have been put in place to manage fisheries has not been well accepted by resource users, leading to the violation of these regulations by fishers whether they are industrial, medium-scale or individuals fishing for their daily food and income and the practical failure of governments to enforce the regulations due to a lack of resources (Viswanathan and Sutinen, 1998).

Since the 1960's the participation of local resource users and communities in development and management has become part of the development process in Southeast Asia. However, community organizations are rather weak in co-management in Asia. There is an increasing commitment of the Southeast Asian governments to decentralize policies and community-based resource management. In developing countries community management and co-management approaches that involved the crafting of new institutions at the local and community level appeared. These movements reflect a paradigmatic shift in fisheries management, both in terms of balance between overall goals and balance in the distribution of authority and power (Siar et al., 2006; Jentoft and Mccay, 2003; Hanna, 2003).

Co-management and community-based management of fisheries is becoming central to the idea of effective governance of fisheries. Gutierrez, Hilborn and Defeo (2010) in their examination of 130 co-managed fisheries from 44 countries with different degrees of development, ecosystems, fishing sectors and type of resources concluded that strong leadership is the most important attribute contributing to the success of co-management. The first comprehensive global assessment of social, economic and ecological attributes contributing to fisheries co-management success shows that co-management holds great promise for better governance of fisheries worldwide in terms of realizing the outcome of sustainable fisheries. The potential for any governance structure for improving fisheries management depends on proper incentives, decentralized institutional arrangements and cohesive social organizations. All of these are more likely to happen under well-established co-management regimes.

The participation of fishers and other stakeholders reduces the negative economic, social and cultural impact that is traditionally borne by the fishing communities (Lane, 2001). Pomeroy and Ahmed (2006) stated that the potential benefits of co-management include a more open, accountable, transparent and autonomous management process that is more economical as it requires less cost for administration and enforcement. An effective co-management framework may generate benefits for resource users, local communities' conservation and under this arrangement, poverty and resource degradation can be reduced (Brown et al., 2005).

In this paper, co-management is used to mean the sharing of rights and responsibility between the government and fishers. The DOF and the fisheries development authority of Malaysia have provided support to the poor fishing community to secure access rights in the marine fishery in the sea and manage fisheries under various institutional arrangements.

5. Fisheries Co-management in Malaysia

In Malaysia, community-based fisheries management approaches have been implementing over the last two decades. Most of the community-based projects have been driven by the federal government. However, the support towards community management is poor. The government has included community management in the Ninth National Plan; however, there is a lack of agency capacity to support and integrate cooperation (Nopparat, 2009). This section discussed case studies of various co-management arrangements that have been emerged through the initiative of the government and resource users in Malaysia.

5.1 Co-management in Sabah

A traditional community-based approach locally called *tagal* system has been implementing in the freshwater inland river systems in Sabah - one of the federal territories in East Malaysia. The meaning of *tagal* system is 'fishing in river is prohibited by the concerned communities' for a certain period. The local community initiated the management of fisheries in various locations in

Sabah. The Department of Fisheries Sabah (DoFS) has extended support to promote this Community Based Fishery Resources Management (CBRM) approach since 2001. A total of 240 *tagal* fisheries group have been established and registered with the Department of Fisheries Sabah. Local people who have traditional use rights in the river sections were included in the *tagal* fisheries group. Community leaders were selected at the village level who introduced fisheries activities with administrative support from the Department of Fisheries Sabah. The members of *tagal* fishers participated in various fisheries activities. The Department of Fisheries Sabah provided technical support to the organized fishers. The main activities of the *tagal* organized fishers were to protect their fish stocks from poachers, reduce overfishing, protect from illegal fishing practices and other activities that pollute the water bodies. They have established fish sanctuaries and prohibited the use of destructive fishing gears.

The fisher groups have promoted eco-tourism activities which have been successful in *tagal* fisheries project areas. The communities with support from the DOF have acquired the power to resolve social conflicts and violations of rules over fisheries through the village headman or district court. The *tagal* co-management approach has been recognized by the government as this approach has empowered local fishing communities (Sujang and Etoh, 2009). Although the *tagal* co-management approach is promising, they have not been successful in some areas due to weak institutional arrangements, lack of monitoring and enforcement, inadequate credit support, and shortage of government staff.

5.2 Co-management in Langkawi

The government initiated a co-management project in Langkawi in the west coast of Peninsular Malaysia. The Locally Based Coastal Resource Management in Langkawi (LBCRM-PL) a pilot project was implemented jointly by the Department of Fisheries Malaysia and the Southeast Asian Fisheries Development Center (SEAFDEC), and was supported by the Japanese Trust Fund (JTF) from 2001 to 2007.

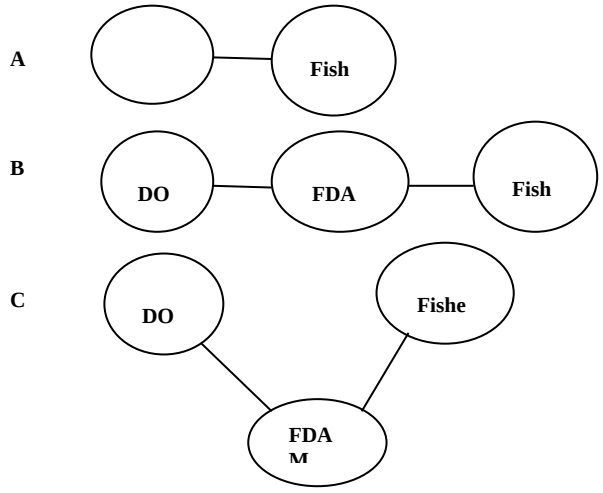

Fig. 1: Models of interactions between the Department of Fisheries, Fisheries Development Authority Malaysia (LKIM), and Fishers in fisheries co-management in Malaysia. Source: adopted from Berkes (1994) and Ahmed et al. (1997).

The Fishery Resource Management Community (KPSP) was organised by the Department of Fisheries Malaysia in several fishing communities in the project area. The DOF provided administrative and technical support to the organized groups. The groups were actively involved in fisheries conservation activities in the project area such as replantation of mangroves, and installation of artificial reefs. In Langkawi, the protection and monitoring of DOF artificial reef sites were managed under a co-management approach between the DOF and the local fishing community. The Implementation Coordination Committee (ICC) was formed with representatives

from the Department of Fisheries, SEAFDEC, fishers and other stakeholders identified from the village. The organized fishers have participated in the project meetings and were able to prepare fisheries resource management plans to implement fisheries management activities. The SEAFDEC and DOF took a major role to play in making institutional arrangements for project implementation. Several fisheries resources management committees were formed under the supervision of the Department of Fisheries and the Fisheries Development Authority of Malaysia (DOF and LKIM). The fisheries management approach has moved from traditional towards a more holistic and ecosystem-based approach (SEAFDEC, 2009). However, due to an inadequate number of DOF staff and lack of access to financial credit sources in the project sites, the implementation of co-management planned activities was not sustainable (SEAFDEC, 2009).

5.3 Participatory management in Fish Aggregating Devices and Artificial Reefs

5.3.1 Department of Fisheries (DOF) and Fisher model

The Department of Fisheries Malaysia (DOF) has deployed artificial reefs or *tukun* with financial support from the government. The main objective of ARs deployed by the DOF was to protect fisheries resources from trawls and to increase biomass and productivity especially in the inshore area. The DOF had imposed fishing restrictions in the immediate vicinity up to a radius of 0.5 nm of its ARs. The DOF had marked the AR locations by marker buoys (DOFM 1985; Jothi, 1986; Wong, 1991). The DOF carried out a technical investigation before deploying the structures. However, local people were not informed and consulted about the location and management of these artificial reefs. Local people did not participate to the artificial reefs program. The fishers suspected the DOF's role to secure their rights to fish in the ARs area. The fishers did not get incentives to protect these ARs from trawls and outside fishers. Moreover, the marker buoys were removed from the ARs. Various fisher groups have conducted fishing surrounding the AR structures. The DOF did not assign use rights to fisher groups, but it has been observed that fishers have become the custodian of most of the ARs. However, the DOF artificial reefs have been less or not protected from fishing, due to a lack of enforcement and local cooperation. The objectives of the AR programs to protect fisheries habitat from trawls have not been achieved, due to lack of proper planning, use of AR materials, site selection and poor monitoring and enforcement (Saharuddin et al., 2012). The existing management arrangements are not sustainable for fisheries where the DOF is solely responsible to manage ARs.

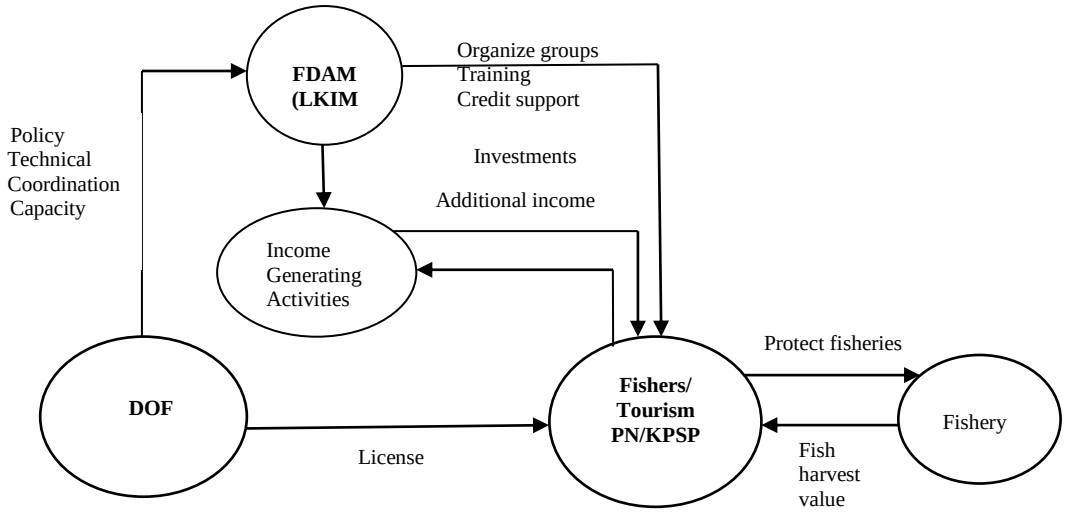

Fig.2: Fisheries rights and distribution of benefits under co-management (government– fisher) partnership approach of fisheries management in Malaysia. Adopted and modified from Ahmed et al. (1997).

In addition to the *tagal* co-management in inland riverine fisheries in Sabah, the protection and monitoring of most DOF artificial reef sites have been managed under a co-management approach between the DOF and local fishing community. The AR committee comprising of locally organised fishers are responsible to protect, monitor and harvest fish in a sustainable manner. Fishing effort was limited to angling, other fishing gears were prohibited within and near the AR sites. They are successful in protecting AR from illegal fishing and the awareness about habitat management improved. This co-management approach is an example of DOF-Fisher model, no NGO is supporting this co-management process.
The DOF provides licenses to fishers based on the fishing boat and gear. Fishers failed to establish formal fishing rights in the ARs that belong to the DOF. In this co-management model (model A in Fig, 1) the DOF provides support for the management of ARs, where the FDAM has limited or no direct role in co-management. The fishers did not get support from non-government organizations (NGOs).

5.3.2 *Fisheries Development Authority (LKIM) and Fisher model*
Fish aggregating devices or *unjam* deployed by the Fisheries Development Authority (FDAM) with financial support from the government. The main purpose of deploying FADs in the coastal areas was to secure access to the poor fishers for improving their economic condition. The *unjams* were deployed mainly at the request of artisanal fisher groups or fishermen associations from the fishing community in coastal areas. These groups had also participated during the deployment and mooring of these *unjam*s and subsequently become the main beneficiaries of FDAM. The fishers groups have eventually become self-appointed custodians of these *unjam*. The fishers have protected the devices from other fishers who do not belong to their group. The fisher groups have established their user rights to these *unjam*, have established *de facto* property rights. This partnership arrangement was acceptable to the government agencies and subsequently developed a partnership between FDAM and fisher groups (model B in Fig. 1). There is no license fee imposed on the *unjam* users. A variety of materials and designs were used to attract demersal and pelagic species. The main motivation for the local fishers is that the FADs were built for improving their economic conditions through fishing and tourism activities. The FDAM and the users worked out the rights and responsibilities over the FAD structures. However, the FADs were seen to be publicly owned with fishers having unlimited access, where the fishing community was less motivated to protect their resources.

5.3.3 *Management of privately owned Artificial Reefs*
Traditionally fish aggregating devices or artificial reefs have been constructed and owned by individual boat owners (purse seiners) or groups of boat owners. The owners of these FADs are generally the rich people called *toukays* or fishery merchants. The fishery investors are called fishery agents or fishery lords in other parts of Southeast Asia. The agents provide credit and fishing equipment to the fishers and get a higher return from fishing. The owner of the FADs has developed an exclusive management regime over the fishery surrounding the FADs. They can manage their FADs with administrative support from the Department of Fisheries and Fisheries Development Authority. The private *unjams* are made primarily of coconut fronds and their placement is not restricted to the 0-5 miles waters (Jahara 1994). However, various size and designs of FADs with scrap materials, treetrunks and bamboos were deployed to attract fish. The owner used about 20 units of FADs for one cluster and each owner has got 100 clusters deployed in the coastal areas.
Generally, the FAD owners do not take part in fishing activities. They usually rent out their FADs and transfer the use rights to others. The owner of the FAD is responsible to maintain their FAD structures every year. They obtain technical advice from local DOF staff. The groups have also introduced an acceptable benefit-sharing system in the FADs. In this system, the owners were able to govern access rights and use of the fisheries resources. The fishery has been no longer open-

access common property. The coastal public waters have been gradually privatized through the construction of FAD or ARs in coastal waters in Malaysia.

The privately-owned FADs are also managed jointly with Fishermen's Association (Persatuan Nelayan Kawasan). The Fisheries Development Authority provides financial support to the artisanal fishers to undertake various income-generating activities. In this participatory approach, the owner of the *unjam* transfer all management and maintenance responsibility to the fisher groups. The fishers pay a share of their income from fishing to cover the construction costs of FADs. Benefits from fishing were distributed among fishers. The fisher groups have subsequently the owner of some structures after paying all the construction costs. The fisher groups finally the owner of these FADs. The fisher groups get technical, organizational and credit support from Fisheries Development Authority (LKIM). The DOF also provided technical support to the organized fishers. These arrangements have developed a partnership between the DOF, LKIM and fishers. The management approach between the government and fishers is an ideal co-management arrangement where NGO support is lacking (Berkes, 1994).

The fisher groups are homogeneous; they live in the same community using artisanal gear such as handline, trap, driftnet and purse seine. Fishers have participated in fishing activities, protected their FADs from other fishers and distributed their benefits among fishers. The support towards community organisations for this co-management approach is still slow due to the lack of institutional and legal support to the fishers. The FDAM initiated to provide "user rights" to the artisanal fishers over the fisheries resources around *unjam*. They have encouraged fisher groups to be responsible for effective resource management and conservation practices. This approach has created incentives for the fishers to participate in fisheries and ensure equitable access.

6. Discussions

The centralized management approach implementing in Malaysian fisheries has been proved ineffective. The licensing policy has secured rights to fishers to fish in the assigned fisheries zones, but fishing competitions have continued to increase in inshore fisheries. The encroachment of bottom trawls in the inshore areas has intensively exploited the fisheries habitat. The Department of Fisheries deployed artificial reefs which have been used as anti-trawling devices in the inshore coastal areas. However, fisheries are not protected from trawls due to a lack of enforcement and monitoring. The current management policy failed to resolve the problem of fisheries overexploitation and inequitable benefits from fisheries.

It is widely recognized that community management with strong local institutions can be a solution to these problems in fisheries and can attain sustainable and equitable management of fisheries. The Department of Fisheries and the Fisheries Development Authority are the two most important government agencies responsible for fisheries in Malaysia. The DOF and FDAM have been providing support to fishers to achieve economic, social and conservation objectives in coastal fisheries.

The co-management arrangements have developed through the initiatives of local people in the coastal community in Malaysia over the last two decades. The existing co-management approaches in Malaysian fisheries have been discussed in this paper. The Department of Fisheries was the main partner of *tagal* fisheries in Sabah, co-management in Langkawi coastal fisheries and co-management in artificial reefs in several coastal areas in Malaysia.

The DOF has provided licenses and organized poor fishers in the coastal communities in Sabah and Langkawi shown in model A in Fig. 1. In this model, the fishing community participated in resource management activities with administrative support from the DOF.

The FDAM provided fisheries subsidy and other livelihoods support to the local fishers to promote income-generating activities and the welfare of fishing communities. However, institutional support was rather poor in fisheries community management in Malaysia. Fishers have not achieved organizational strength to deal with the government directly. It was found that the organized fisher groups did not get enough institutional support from the DOF and FDAM. The organized fishing

groups were not successful in protecting their fisheries from trawls and other illegal fishing activities.

The DOF and FDAM have provided institutional support to poor users and to establish a partnership arrangement to achieve social, economic and conservation objectives is shown in model B in Fig.1. The FDAM play an effective role to strengthen the community institutions through providing access to fisheries and venturing into other commercial activities. The FDAM has provided operational support to the fisher groups and provided credit support to invest in various income-generating activities.

The participatory co-management in FADs and artificial reefs fisheries has demonstrated the partnership arrangement of DOF-LKIM-fishers shown in model B in 1. The FDAM has played a greater role in securing user rights to fish surrounding the FADs. The fishers were organized under the LKIM framework, fisher leaders were selected through the democratic process, and they were responsible to manage their FADs with technical and administrative support from FDAM and DOF local staff. This institutional support has strengthened the social, economic position of artisanal fishing communities, and created a sense of ownership over the fisheries.

However, the management of artificial reefs has demonstrated that the DOF did not incorporate local fishers in the planning and management of the AR programs. The government allowed private individuals to deploy FADs where they have established their *defacto* property rights. The relatively rich people invested in FADs and major benefits go to the private owner of these structures. Due to the free access to fishing in the ARs areas; most productive parts of artisanal fishers are continued to capture by the rich people with employing more effective gears. The FAD owners have established exclusive fishing rights in the area which means that fishing intensity increases that pose threat to fisheries resources, the resources will be further depleted. These will affect negatively on the sustainable catch and incomes of artisanal fishers.

The ARs and FADs with concrete structures were not suitable for fishing, especially for the drift net users. The hand line, long line and traps user were able to fish around AR areas without any serious problems of entanglement. Social conflicts arise due to an entanglement problem between fishing groups using same locations (Islam et al, 2014). Sutton and Bushnell (2007) highlighted that conflicts within groups of AR users usually come about due to crowding and congestion at AR sites.

Several studies suggest that management of AR should be consistent with fisheries management, e.g. to avoid stock overexploitation, through unexpected reallocation of fishing effort over space around AR (Polovina, 1991; Botsford et al., 2003; Denny and Bobcock, 2004). Pickering and Whitmarsh (1997) argue that ARs have serious problems of distribution in the absence of an effective management strategy.

There is a need to have more flexible and community-oriented management of the fishers. The DOF and FDAM should be willing to accept each other's role. This would require poor fishers as stakeholders and put in place mechanisms that would serve to foster closer DOF, FDAM, and community linkages. Sufficient extension services to the target groups are required to enable these community-based organizations to perform useful functions. Local credit institutions including banks should introduce a simple credit delivery mechanism to supply adequate financial credit to the fishers. Sufficient, timely and sustained funding is critical to the sustainability of co-management efforts. Often co-management projects which are initiated and funded from outside sources fail when the project finishes due to the inability of the partners to fund the activities.

The excess fishing problem is generally found in the fishers due to unclear property rights. The existing property rights arrangements are complex in Malaysia and other Southeast Asian countries. Fishers and community members have low incentives to contribute to the community fishery. Without seeing any tangible benefits, community members are less willing to invest time and effort in fisheries management.

Individual and community empowerment is a central element of co-management. Empowerment allows communities to be free from the bureaucratic requirements of government agencies. The experience shows that there is a lack of capacity building, confidence and a sense of empowerment of resource users. The co-management experience suggests that FDAM could play a very important

role in facilitating to establishment local co-management. The focus of co-management is on building fisher community organizations that can themselves manage fisheries through interaction with the government.

It has been observed that homogeneous communities are more likely to establish effective community-based fisheries management. Successful co-management was dependent on the high level of socio-economic and cultural homogeneity of the community. However, the co-management project was also successful in socio-economically and culturally heterogeneous communities.

In Malaysia, none of the co-management groups is graduated and become self-sufficient. Establishing sustainable co-management in any one fishery requires time. The capacity of the CBO needs to be established as a sustainable organization and a legitimate decision-making body to decide on access and use of the fishery. Strong political will and commitment are needed to counter pressure from fisheries agents and intermediaries. An ownership feeling should come through the active participation of fishers.

7. Conclusion

Fisheries co-management as an alternative to centralized command and control fisheries management is often suggested as a solution to the problems of fisheries resource use conflicts and overexploitation. In Malaysia, community-based fisheries management has been experimenting over the last three decades.

Co-management programs implemented in inland riverine fisheries in Sabah have demonstrated that the organized fishers can effectively manage their resources with support from the Department of Fisheries. The co-management model has established between government and fishers seemed to be more sustainable and equitable management in fisheries.

Co-management has also demonstrated in coastal marine resources in Langkawi with a similar co-management framework where the Department of Fisheries has provided major institutional support to the local fishing communities with technical and financial support provided by the Southeast Asian Fisheries Development Centre (SEAFDEC).

Various management approaches exist in fish aggregating devices or unjam deployed in various locations in coastal areas in Malaysia. The organized fishers have established their use rights in FADs installed by a private individual and by Fisheries Development Authority Malaysia. The DOF provides license to the fishers for fishing with particular gear. The FDAM has provided organizational support, registration of fishermen association, credit and other livelihood support. This co-management has developed with the partnership of DOF-FDAM-fishers in many locations in the coastal areas.

The co-management arrangements are still experimenting and none of the co-management groups have successful. The process of reformation from traditional centralised management to community-based decentralised management is extremely slow in Malaysia. The Malaysian Government has included community-based management policy in the Ninth Malaysia Plan 2006-2010. The Government has encouraged the community to participate in enforcement activities: monitoring, control and surveillance (MCS). However, there is a lack of agency capacity to provide institutional support to fishers. There is a danger to allow a private individual to deploy FADs. The issue of ownership of these resources is not clear. The process of privatization of public waters is unsustainable and it will create a negative impact on the distribution of benefits.

The poor fishing groups were not able to secure user rights to fisheries. Therefore the sense of ownership in their resources has not been established. The increasing number of FADs are occupied the fisheries' habitat especially in the near shore areas. The main issues are ownership, accessibility; use rights and the overall management of fisheries resources around these structures.

There is a need to find a mechanism to empower target groups who could enforce the fisheries rules and protect fisheries resources.

The experiences from Southeast Asia indicate that the establishment of CBFM and co-management takes time but once established, this management regime can bring about improved efficiency,

equity and sustainability of resource use. The main obstacle in fisheries is the lack of coordination between the DOF and FDAM. There is a dilemma about the role of DOF and LKIM towards the welfare of fishers. The agencies should have clear goals and expectations in fisheries management. The DOF is reluctant to share their regulatory power to the FDAM, moreover, they have an artificial reefs program with a different desire. The role and operational strategies among the agencies and stakeholders should be clearly understood. The fishers do not have direct communication with the DOF. There should be a communication channel to inform the fisheries issues.

Effective coordination of FDAM and DOF are not easy to establish but are extremely necessary to support new community institutions for fisheries management. The important policy implication is that the fisher groups of co-management organizations need strong facilitation by DOF and FDAM to establish access to fisheries. Successful co-management is more likely to occur in homogeneous communities.

The long-term commitment is required for the sustainability of fisheries associations. Many co-management projects have been supported by donors for extended periods. The sustainability of co-management projects is often an issue when they are donor-driven and heavily dependent on external funding. To improve performance and strengthen partnership, DOF, FDAM, PNK and other stakeholders have to go through a social learning process and be willing to accept each other's roles and responsibilities.

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It's the company you keep that matters: A study on effects of friends and mentor on opportunity recognition

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Abstract

Purpose - the purpose of this study is to examine the relationships of social networks and entrepreneurial opportunity recognition of small technology firms in Malaysia. The study seeks to explore the gaps between the practice of mentoring in technology start-up firms.
Design/methodology/approach – this paper employs a quantitative research design involving self-reporting questionnaires. Founders and co-founders of technology companies (n=255) are surveyed as respondents and data collected are analyzed using PLS-SEM technique.
Findings – Findings have shown that both casual friends and mentors affect the entrepreneur's ability to recognize opportunity but each in its different ways. Entrepreneurs who possess wider social contacts benefits from a wide array of information which plays a key role to opportunity previously not recognized either due to lack of information or resources to exploit. Mentors, on the other hand, influence the entrepreneur's ability to recognize opportunity through the preparation of the mind in a state of readiness to recognize opportunities. To identify opportunities, a weak tie network is best suited to spark the imagination of the entrepreneur in novel ideas.
Practical implications – From a more practical standpoint, the use of mentorship programs in entrepreneurial and incubation initiatives needs to be clear on the expected role and outcome for the mentor. Without a doubt, mentors play an important role in the maturing process of a novice entrepreneur but the key to effective mentorship is the 'how' the mentors' influence.
Originality/value – The clear delineation of the opportunity construct within the entrepreneurship studies enables progress to be made in building a clearer opportunity recognition framework. The empirical results are also supporting the presence of entrepreneurial alertness as the mediator in the model. This relationship has not been explored and empirically proven.

Keywords Opportunity recognition, Mentor

Introduction

All businesses exist because they fulfill the needs of society through their offerings of products and services. Embedded in the concept of business survival is the necessity of procuring value to customers. The ability to add value to the process chain is often acted upon by entrepreneurs who discovered or created the opportunity that allows them to exploit the gaps within the market. Therefore, the cornerstone of a business venture is the ability of the entrepreneur in recognizing opportunities. Unsurprisingly, the focus of entrepreneurship research has been on the concept of opportunity (Shane and Venkataraman, 2000). Reviewing past opportunity recognition literature, various factors were found to have a strong influence on the ability of the entrepreneur to recognize opportunities. Among the factors established are personality

traits (Shane and Nicolaou, 2015), individual cognition (Edelman and Yli-Renko, 2010), prior knowledge (Shane, 2000), entrepreneurial alertness (Gaglio and Winter, 2017) and social capital (Lin, 2017).

Entrepreneurs do not work alone. The social network surrounding the entrepreneur plays an important role in determining their behavior and action. A social network is one of the sources for knowledge and business ideas and it is the characteristics of the network that helps facilitate the transfers of knowledge enabling entrepreneurs to spot opportunities better than others (Arenius and de Clercq, 2005). The social network has been studied by many researchers in pursuing the 'who' and 'what' influences the recognition of opportunities for entrepreneurs (Ozgen and Baron, 2007; Bhagavatula et al., 2010; Li et al., 2014). Despite past studies illuminating the effects of social networks on the opportunity recognition process, little is known about the actual 'how' or the operations of cognition leading to the recognition of opportunities. The purpose of this study is to examine the relationships of social networks on entrepreneurial opportunity recognition of small firms technology firms in Malaysia. The study seeks to explore the gaps between the practice of mentoring in new start-up firms. To further our understanding on the roles social network has on opportunity recognition process, this study seeks to uncover how mentors and weak ties affect opportunity recognition through dimensions of entrepreneurial alertness: scanning and search; association and connection; evaluation and judgment. From the practical viewpoint, the contributions from the current findings on the social network confirm the effect of mentors and weak ties on opportunity recognition in its way. Mentorship programs and networking sessions need to be better developed to harness the strength of each type of network.

The rest of the paper is as follows. First, the review of the literature on the opportunity recognition concept is presented together with entrepreneurial alertness which is a strong determining factor to opportunity recognition. Next, the types of social networks; mentors and weak ties are outlines on their roles and effect on the opportunity recognition process. The design of the research undertaken in this study is discussed in the methodology section followed by the presentation of the results of the analysis conducted. The paper concludes with discussions on the findings, in particular, relating to theory and practice.

Opportunity recognition from the cognitive perspective

As the key concept within entrepreneurship studies, opportunity recognition explains in part the difference between an entrepreneur and a non-entrepreneur. Most researchers agree that one of the most important functions of an entrepreneur is to identify and exploit opportunities taking advantage of market disequilibrium.

Hence, opportunity recognition can be defined as the cognitive process by which the entrepreneur through which an individual concluded that an opportunity has been identified (Baron, 2006).

The question of interest to researchers is how do the entrepreneur spot opportunities and not others? An indication of this emerges from the cognitive perspective study that proposes the human cognitive framework of the entrepreneur gathered from past experiences enables the entrepreneur to see a pattern in market changes. In their entrepreneurial journey, entrepreneurs gather both tacit and explicit knowledge about the market, technology, government policies, customer problems and industry, enriching the stock of knowledge and experience of the individual (Tang et al., 2012; Li et al., 2015). The information gleaned is inter-linked in its unique way to the entrepreneur and is described as a pattern. In a situation when a similar pattern of information emerges from the market, the entrepreneur is ready to recognize and identify the pattern. In that, the ability of the entrepreneur to recognize the opportunities from the market is termed entrepreneurial alertness (Tang et al., 2012). Alertness affects the ability of entrepreneurs to recognize opportunities directly. Entrepreneurs who possess higher levels of alertness can recognize more opportunities compared to others. The concept of alertness and opportunity recognition is deeply rooted in Kirzner's (1997) study. The Kirznerian view opportunities as something that is there to be discovered by the entrepreneur who is highly alert to information gaps in the market. Hence, the ability of 'alertness' is what sets the entrepreneur apart from the general population (Kirzner, 1997).

The concept of alertness is presented in three dimensions extending the concept as part of the entrepreneurial cognitive process: Scanning and searching; association and connection; evaluation and

judgement. As a cognitive process, an alert entrepreneur would be constantly scanning and searching the environment for any new information or shift in the market environment. Individuals who are better prepared with high levels of knowledge would be in a better position to see opportunities. In the second dimension, the alert entrepreneur can make connection and association between separate pieces of different information building from it variations of possibilities. In the last dimension, evaluation and judgment, the individuals process the information and evaluate the changes and shifts of the market in their value as a potential business opportunity (Tang et al., 2012). For the opportunity to happen, the entrepreneur goes through the cognitive process of gathering information making sense out of it and deciding if there exists an opportunity.

There have been some studies conducted on the relationship between alertness and opportunity recognition. However, the results are inconsistent partly attributed to the issues of conceptualizing the construct (Li et al.,2015; Gaglio and Winter, 2017). Moving towards the cognitive perspective, alertness is being studied in the context of the information processing model with various studies attempting to the skills and ability that drives alertness (Gaglio and Katz, 2001; Ko and Butler, 2006; Tang et al., 2012). In the latest study by Ali and Mohammaedreza (2016), the result confirms the positive relationship of alertness on opportunity recognition. Particularly, the study was made on biotechnology companies which highlighted the importance of information to a fast-paced industry such as a technology industry.

Mentors and weak ties

The network of relationships that surrounds the entrepreneur is an important aspect of business performance as the type of social network the entrepreneur possess determines the types of resources that are being channelled. Through social networks, entrepreneurs can gain various support, assistance and resources such as financial resources, human resources, equipment and machineries and even lend legitimacy for the new venture. Other than physical resources being mobilized through social network, information too are also channelled through. Different types of networks with different characteristics would affect the type of information and its impact on recognizing opportunities. One important type of social network to an entrepreneur is the weak ties relationship. A weak tie relationship refers to relationships with casual acquaintances such as customers, suppliers, government officials and strangers. The relationship is characterized by weak bonds, low interactions and low commitments. Such weak ties relationship though low on trustworthiness between the parties provides a rich structural holes network that is loose and diverse. The non-redundant nature of a weak ties network is that it allows for non-redundant information such as information on new market segments or products to be disseminated (Stam and Elfring, 2008). Such information are new information which is beyond the normal circle of the entrepreneur and it can bridge across to different network bringing diverse information from a variety of networks. Entrepreneurs with a high number of weak ties network will benefit from access to various knowledge which in turn increases the probability of spotting an opportunity.

In the study conducted by Ozgen and Baron (2007), it was found that informal network, mentoring as well as a professional association has a positive impact on opportunity recognition. Though mentoring has been studied in the management literature and much has been known about the benefits of a mentor, there however, exist deficiencies in our knowledge on mentorship in entrepreneurship (Wilbanks, 2015). Much less is currently known about the effectiveness of mentors in the entrepreneurial opportunity recognition context. In a study by St-Jean (2011), different groups of mentoring functions were found in developing relationships between the mentor and mentee (novice entrepreneurs). Therefore, the emphasis is placed in the need to examine further the phenomena of mentorship within a specific context. There are various definitions of what constitutes as a mentor. However, most definitions tend to contain attributes such as: reciprocity, developmental benefits; and consistent interaction over some time (Wilbanks, 2015). Reciprocity can be referred to as a relationship of mutual social exchange where both parties work to maintain the relationship.

Considering the effect of entrepreneurial alertness on opportunity recognition and in turn, the impact of weak ties and mentors on alertness, this current study is driven to examine the mediating role of alertness with its

different dimensions between social network and opportunity recognition. Such aspect of the relationship has yet to be empirically tested and explored by previous researchers. Past studies have acknowledged the positive impact of weak ties on the abilities of the entrepreneur in recognizing opportunities (Elfring and Hulsink, 2003; Wang et al., 2013). However, most of the studies have focused on the direct impact of weak ties on opportunity recognition neglecting the cognitive process of entrepreneurial alertness. The social network of the entrepreneur does not directly hand the entrepreneur with opportunities.

Rather, such realization of idea and opportunity is a product of cognitive process manifestation. Hence, entrepreneurial alertness is an essential concept and a vital component to the missing part of the opportunity recognition process.

New and inexperienced entrepreneurs are generally limited in their knowledge and ability. Due to this limitation, new entrepreneurs find themselves at a disadvantage in identifying potential opportunities. To overcome this limitation, new entrepreneurs can seek support from mentors who possess higher levels of experience and knowledge to help them to recognize opportunities. In the study by Baron and Ensley (2006), the results show differences in cognitive schemes between experienced entrepreneurs and new entrepreneurs. It was found that experienced entrepreneurs can develop new product and services which are more specific and hence more probable to generate revenues. Therefore, having a mentor which is an experienced entrepreneur could enhance the new entrepreneur's cognitive processing to be more effective in recognizing opportunities. Particularly, the recognition of opportunities is developed through the cognitive processing of information by being alert to market changes and new information that occurs. A mentor would better enhance the skills of a new entrepreneur in showing him or her where and how to look for relevant information that is particular to the industry and market. This widens the breadth of information received allowing for more connections between the information to be made. The more experienced mentor may also share and bridge pieces of information making the links visible to the new entrepreneur in understanding how the forces of the market influence each other. Studies have shown that each entrepreneur is unique in their way with a specific stock of capital which activates an idea into an opportunity for some while remaining as an idea only to others (Ko, 2004). An idea in its raw form holds little value and each idea has to be further refined and develop before it can be an opportunity. To transform such into a viable opportunity, the individual entrepreneur has to further evaluate the opportunity bridging the market needs with the resources attached to the particular entrepreneur. Like pieces of puzzles, an experienced mentor can show the protégé how an opportunity can be constructed from available resources currently held crafting economic value from the opportunity of an idea. Working through the cognitive process of entrepreneurial alertness, a mentor supports a new entrepreneur with better opportunity recognition skills. Hence, this study posits:

H1. Mentor supports higher recognition of opportunities through scanning and searching of information.

H2. Mentor supports higher recognition of opportunities through association and connection of information.

H3. Mentor supports higher recognition of opportunities through evaluation and judgment of information.

Casual acquaintances that are known as weak ties are unique sources of information for an entrepreneur. A loose network characterized with high structural holes provides information which is distinct and non-redundant from one network to another. The non-redundancy of information increases the breadth of information which in turn increases the possibility of obtaining the right complement of the necessary information for opportunity recognition. Weak ties relationship can help entrepreneurs identify more opportunities with new information which are diverse. This widens the base of information available and discussion with weak ties generally tends to develop more new ideas and are of radical innovations.

To date, there have been very few studies relating weak ties and opportunity recognition which are empirically tested and none with entrepreneurial alertness as a mediator. A diverse network with volumes of non-redundant information allows the entrepreneur a better probability of spotting opportunities through scanning and searching. Entrepreneurs who possess more weak ties relationship have access to a wide variety and distinct information which increases the chances of making connections between the disparate

pieces of information into viable opportunities. Beyond connecting the dots of various information, weak tie brings radical ideas to the fore of discussion among people with differing mindsets. Benefitting from different mindsets, the entrepreneur may evaluate and judge potential opportunities differently then otherwise from discussions with close family and friends. An entrepreneur already engaged cognitively by being alert to environmental changes will benefit from having a diverse and wide network of information prompting the skills to recognize a higher number of opportunities. Hence, this study posits:

H4. Weak tie supports higher recognition of opportunities through scanning and searching of information.

H5. Weak tie supports higher recognition of opportunities through association and connection of information.

H6. Weak tie supports higher recognition of opportunities through evaluation and judgment of information.

Methodology

This section describes the sample used as well as the measurements adapted for the analysis of hypotheses. This empirical study attempts to uncover the mediation relationships of entrepreneurial alertness between social network and opportunity recognition. The research subject identified for this study is the technology industry which is heavily reliant on knowledge-based industry. It is a suitable target as entrepreneurs operating in the technology industry face strong pressure to continuously innovate and discover new opportunities. The targeted respondents are the founders and co-founders of technology companies. The sampling frame of this study totalling about 2,600 companies listed is obtained from the directory of Malaysia Digital Economy Corporation (MDEC), a government agency entrusted with the responsibility of overseeing the technology industry in Malaysia. To select the samples, a systematic selection method is employed for efficiency. Using a self-administered questionnaire, the distribution of the questionnaires was conducted through emails and personal interviews. In total, the number of usable responses collected and are used for further analysis was 255.

Most of the respondents of the survey are males (79.2%) with the females (20.8%) as minorities. They are mostly from the age group of 25 to 35 years (38%) and 36 to 45 years (30.2%) with the smallest group from the band of those below 25 years (5.1%). The sample mostly included entrepreneurs of ethnic Chinese descent (58.4%), followed by entrepreneurs of ethnic Malays (22.7%), Indians (12.2%) and others (6.7%). The technology-based entrepreneurs are also seen in general to be higher educated than the general population with the largest group educated with an undergraduate degree (59.2%) and the second-largest group with a post-graduate degree (23.5%).

The measures adapted in this study were based on previously published studies. To measure 7 variables, a total of 38 items were adapted with most using the 5 points Likert scale measuring level of agreeableness to the given statement.

To measure the variables of social network, respondents were asked to indicate their level of agreement to statements regarding various stakeholders in helping them to recognize opportunities. The measurement items for mentors were adapted from St-Jean and Tremblay (2011) and Ozgen (2003) with a total of 5 items reflecting the variable. To measure weak ties, a total of 5 items were adapted from Ozgen (2003) and Ko (2004). To measure entrepreneurial alertness and the three dimensions of alertness, a total of 24 items were adapted from Tang et al. (2012) with 8 items to reflect on each of the 3 dimensions (scanning and searching, association and connection, and evaluation and judgment). The alertness construct represents the process that entrepreneurs experience in being aware of information and movement towards action as well. Lastly, the dependent variable of opportunity recognition represents the number of opportunities recognized and exploited. It is measured by 4 items adapted from Ko (2004), Singh (2001) and Tong (2006). The items are measured with a 10 point scale where respondents are required to select the number of ideas or opportunities ranging from “0” to “11 and above”. The construct is made up of items such as “on average, how many business ideas did you have in this past year?” and “Based on the ideas that you have had in the

past year, how many are potential business opportunities?". The final number is regarded as an index measure of entrepreneurial opportunities recognized.

The analysis of this study employs the Structural Equation Modelling technique (SEM-PLS) using SmartPLS software. Using SEM, the measurement model and structural model of the proposed model are examined. An advantage of the SEM technique is its ability to simultaneously model relationships among multiple constructs. In addition, SEM-PLS can account for constructs which are formative such as the construct of weak ties used in this study. The employment of SEM-PLS is also due to its reliability and accuracy in handling mediation effects as it accounts for errors that are capable of improving the validity of theory (Henseler et al., 2009).

Analysis and results

The measurement model is first established and examined on the latent and observed variables to determine the relationships between the construct and its indicators. To assess the fitness of the model, the cross-loadings of the indicators are checked followed by the reliability and validity of the data collected. Low loadings of values below 0.7 are eliminated. The analysis to confirm the reliability of the items is the composite reliability (CR) index. Results of the initial measurement model are shown in *Table 1*. As shown, all 5 variables achieve the recommended level of 0.7 for reliability index and items with low loadings are eliminated. Hence, the constructs are reliable.

For validity measure examines both the convergent and divergent validity of the measurements. Convergent validity is established by the examination of the Average Variance Extracted (AVE). According to Fornell and Larcker (1981), the recommended AVE value should be above 0.5 value. For divergent validity, the measures are evaluated by measuring the square root of AVE for each variable which is then compared to the correlation coefficient of other constructs. The diagonal value in bold should be of higher value then the correlation between that construct and the other construct in all cases. As shown in *Table 2*, all the 5 constructs achieved a good level of convergent and divergent validity. The construct weak ties are formative measurements which by nature do not correlate highly with each other. Hence, weak ties are assessed on its outer weights and collinearity of their indicators.

	Items	Loadings	AVE	Composite Reliability
Association & connection	AC2	0.719	0.622	0.920
	AC3	0.775		
	AC4	0.802		
	AC5	0.791		
	AC6	0.835		
	AC7	0.786		
	AC8	0.808		
Mentors	M1	0.714	0.708	0.923
	M2	0.817		
	M3	0.910		
	M4	0.896		
	M5	0.856		
Opportunity recognition	OR1	0.824	0.741	0.919
	OR2	0.920		
	OR3	0.890		
	OR4	0.805		
Scanning & searching	SS1	0.716	0.629	0.910
	SS2	0.776		

	SS4	0.724		
	SS5	0.806		
	SS6	0.874		
	SS7	0.852		
Valuation & judgment	VJ2	0.803	0.622	0.920
	VJ3	0.751		
	VJ4	0.778		
	VJ5	0.808		
	VJ6	0.842		
	VJ7	0.773		
	VJ8	0.760		0.000

Table 1: Reliability measure

In examining the weights of the weak ties items, 3 of the 5 items were found to be not significant with low weight values. However, on examining the collinearity among the indicators, the VIF values of all weak tie (1.279 – 1.969) indicators falls within the recommended band of between 0.2 and 5.0 with tolerance value all higher than 0.2 (0.508 – 0.782) as suggested by Ringle et al., (2013). All the 5 items of weak ties are maintained as the items do not pose any collinearity issues and any elimination of items may risk altering the content validity of the construct.

After the measurement model has been established, the study moves to establish the structural model with the graphical output which displays the overall fitness of model and the relationships between the variables. To assess the overall goodness of fit of the model, checks will be done on latent variables and the relationships between them. Analysis such as R^2 and Q^2 is employed to confirm the goodness of fit and the predictive power of the model whereas f^2 is employed to confirm the relative impact of the predictor on the endogenous construct.

	AVE	**Associate & connection**	**Mentors**	**Opportunity recognition**	**Scanning & searching**	**Valuation & judging**
Associate & connection	0.622	**0.789**				
Mentors	0.708	0.133	**0.841**			
Opportunity recognition	0.741	0.415	0.159	**0.861**		
Scanning & searching	0.629	0.661	0.354	0.339	**0.793**	
Valuation & judging	0.622	0.641	0.226	0.402	0.603	**0.788**

Table 2: Validity measures

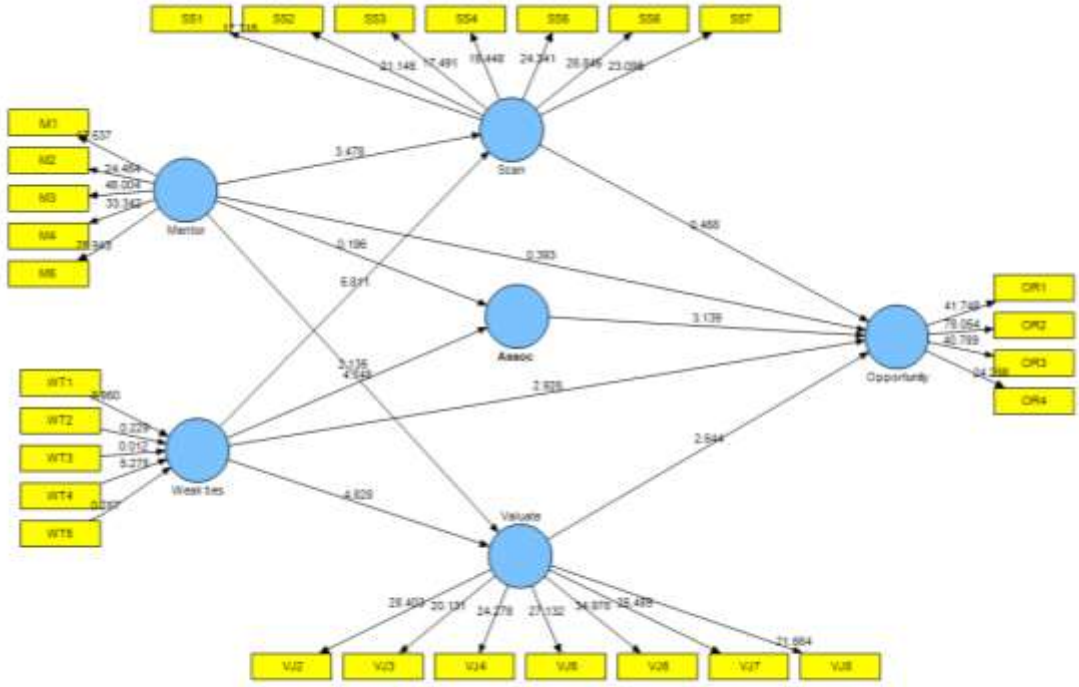

Figure 1: Structural model

The results indicated that the opportunity recognition constructs achieved a moderate effect of R^2 (0.242) as recommended by Cohen (1992) and establishes the predictive power of the model with Q^2 above 0. In addition, the effect size of the entrepreneurial alertness dimensions on opportunity recognition was found to be of small effect (0.131) as recommended by Cohen (1992).

Construct	R^2	Q^2	f^2
Associate & connection	0.127	0.002	
Opportunity recognition	0.242	0.102	0.131
Scanning & searching	0.249	0.056	
Valuation & judging	0.128	0.026	

Table 3: Structural model results

In order to confirm the hypotheses, the measurements of t-values will be examined by path analysis. The outcome of path analysis with the path coefficient is shown in Table 4. For mediation analysis, the procedures recommended by Preacher and Hayes (2008) for bootstrapping are employed with a re-sampling of 5000 samples. The results of the mediation analysis are shown in Table 5. The first group of hypotheses which involves the mediation relationships between mentors and opportunity recognition through dimensions of entrepreneurial alertness are set in H1 to H3. The results indicated no significant mediation relationship for H1, H2 and H3. Confirming the results at 95% confidence interval, the bootstrapping confidence interval straddled zero in between indicating no mediation effect for H1 [LL=-0.045, UL=0.028] and no significant relationship (β =-0.008, t =-0.445). Similar results were found for H2 (β =0.003, t =0.182) and H3 (β =0.127, t =1.586) which showed no significant relationship and is further confirmed by the bootstrapping confidence interval which contained zero in between. Therefore, there were no significant mediation effects of mentors on opportunity recognition through searching and scanning; association and connection; and evaluation and judgment.

Relationship	Std.Beta	Standard Error	t-value
Mentor -> Scan	0.201	0.058	3.503
Mentor -> Assoc	0.014	0.072	0.195
Mentor -> Valuate	0.127	0.059	2.145
Weak ties -> Scan	0.394	0.070	5.656
Weak ties -> Assoc	0.351	0.074	4.754
Scan -> Opportunity	-0.041	0.086	0.482
Assoc -> Opportunity	0.244	0.075	3.266
Weak ties -> Valuate	0.295	0.062	4.774
Mentor -> Opportunity	0.027	0.068	0.394
Valuate -> Opportunity	0.194	0.073	2.671
Weak ties -> Opportunity	0.207	0.068	3.044

Table 4: Path analysis

In the second set of mediation hypotheses that are examined, the mediation relationship between weak ties and opportunity recognition through the dimensions of entrepreneurial alertness are analysed. H4, H5 and H6 are tested using the bootstrapping procedure and checking the spread of upper limit and lower limits of 95% confidence interval. The results found support for the mediation relationship of entrepreneurial alertness in H5 and H6. In H5, the hypothesis is supported (β =0.086, t =2.520) with results of 95% confidence interval spread not to contain zero. This indicates the presence of partial mediation (VAF = 29.2%) effect of the association of information between weak ties and opportunity recognition. Similarly, for H6 (β =0.057, t =2.071), the hypothesis is also supported as results from the confidence interval does not contain any zero. The effect of mediation is a partial mediation (VAF= 21.7%) as recommended by Hair et al. (2014). However, H4 (β =-0.016, t =-0.452) was not supported in the alertness (scanning) as a mediation between weak ties and opportunity recognition.

Relationship	Indirect Effect	Direct Effect	SE	t-value	95% LL	95% UL
H1: Mentor>Scanning> Opportunity	-0.008	0.027	0.019	-0.445	-0.045	0.028
H2:Mentor>Association> Opportunity	0.003	0.027	0.019	0.182	-0.033	0.040
H3:Mentor>Evaluate> Opportunity	0.025	0.027	0.016	1.586	-0.006	0.055
H4:Weaktie>Scanning> Opportunity	-0.016	0.207	0.036	-0.452	-0.087	0.054
H5:Weaktie>Association> Opportunity	0.086	0.207	0.034	2.520	0.019	0.152
H6:Weaktie>Evaluate> Opportunity	0.057	0.207	0.028	2.071	0.003	0.112

Table 5: Mediation analysis result

Discussion

This study aims to examine the effect of social network on opportunity recognition through the cognitive process of alertness. Mentors and weak ties both influence the type of information as well as how they are

processed to lead to recognition of opportunities due to the nature of relationships. Scarce previous empirical results hampered by difficulties on conceptualization and measurements of opportunity recognition have limited our knowledge in this area. With the rising importance given to entrepreneurial activities in the technology sector, the role of a mentor is especially important to help guide novice entrepreneurs navigating the intricacies of a new venture in a fast-paced industry. The technology industry is driven by new information and knowledge which is subject to volatile conditions. Therefore, the ability of the entrepreneur to spot opportunities takes an important distinction from corporate managers.

Taking the cognitive perspective to opportunity recognition, entrepreneurial alertness construct is the mental framework that processes information leading to opportunity recognition. In H1, H2 and H3, the effect of mentors on opportunity recognition through alertness in 3 dimensions (scanning, association and valuation) are examined. The results found no support for all 3 mediation hypotheses. No previous studies are being conducted with alertness as a mediator as far as the authors are aware and this current study serves as the few empirical studies to shed light on our understanding of the effects of mentors on the opportunity recognition process. Results of data found that alertness has no mediation effect on the relationship between mentors and opportunity recognition. However, there are significant effects of mentors on opportunity recognition through scanning and the valuation dimension of alertness.

In a previous study by Ozgen and Baron (2007), mentors were found to impact opportunity recognition which this study contradicts. In Ozgen and Baron's (2007) study, the construct of opportunity recognition includes the concept of alertness. Hence, as shown in the results of this current study, mentors have an impact on alertness but not necessarily a direct relationship to opportunity recognition. A plausible explanation to this is the role of a mentor. A mentor teaches and guides the novice entrepreneur at various stages of start-up. They are particularly impactful when their guidance is an actionable objective with specific requirements as mentors can offer their network and bring legitimacy to the new start-up. Mentors are experienced in their cognitive framework and their behavior which enables them to better think from the perspective of business. However, this does not translate to a skill that can be transferred to the novice entrepreneur as cognitively, they need to experience the journey of cognitive recognition of opportunities. In mentorship programs offered in entrepreneurship development initiatives, clear objectives and milestones need to be set. New businesses at different stages of start-up must be matched to mentors of different skills and expertise. Needs and requirements of the novice entrepreneurs has to be clear to ensure the mentors can extend the right help and thus achieve the goals of the novice entrepreneur. The results also suggest that mentors do not contribute directly to the recognition of opportunities. This can be explained again by the role of a mentor which is to guide and to show the way rather than handing opportunities and ideas on a silver platter to the novice.

For H4, H5 and H6 hypotheses, the mediator hypotheses aim to examine alertness as a mediator between weak ties and opportunity recognition. The analysis of the data indicated a presence of entrepreneurial alertness as a mediator. The role of weak ties is an interesting relationship where strangers and acquaintances make an impact on the entrepreneur's business model. Unlike mentors, weak ties are not accompanied with the need for trust whether affectively or cognitively. However, the structural characteristics of such a network bring an unexpected benefit, particularly when scanning for information, making connections between information and evaluating the information leading to an opportunity recognized. The results from the mediation relationship analysis indicated no mediation between of the scanning and search dimension (H4). However, H5 and H6 is supported with the presence of association and search; and evaluation and judgment as a mediator between weak-ties and opportunity recognition. In a study by Ren et al. (2014), the researchers found weak ties to have a stronger direct influence on opportunity discovery over opportunity exploitation when there is the presence of trust. Related to this current study, weak ties are found to impact directly the alertness of the entrepreneur. Due to the nature of information sharing of weak ties, such connections perform best in generating novel solutions through the cognitive process.

The effect of mentors and weak ties on the process of opportunity recognition poses a serious need for the government, industry and academia to examine the initiatives currently in place to increase the level of entrepreneurial innovations. A mentor is not a cure-all solution for the nation's drive in its bid to increase entrepreneurship activities. Entrepreneurship and innovation have long been seen to be hand in hand with each other but in reality, many entrepreneurial start-ups follow the imitation strategy rather than the innovative strategy. Once such careful differentiation is made to the nature of business strategy, it becomes clearer on the type of help required by the entrepreneur.

In most cases, an entrepreneur with an ongoing business requires a mentor specifically knowledgeable in their field of specific business needs such as how to display their goods, paperwork or accounting (Kent et al., 2003). Hence, as indicated by this study, a mentor assists in helping the business through obtaining and evaluating information for the management and expansion of business. Weak ties however impact directly on opportunity recognition. The unfamiliar acquaintances are more suited to spark opportunities that are more novelty in nature. The short serendipitous discussions may stimulate new insights to possible new opportunities not thought of before as the entrepreneur may make new information connections that change the feasibility and attractiveness of the opportunity.

The implication from this study points to a clear delineation of requirements and objectives of a mentor and a weak tie network. To improve the survival of new start-ups, mentors will be well suited to guide and to share their expertise and knowledge on specific issues relevant to the industry. Especially for technology start-ups, mentors will be able to contribute towards solving specific technical problems. On the other hand, promoting start-ups driven by innovative solutions may benefit more from social network that is loosely connected such as a weak tie network. For policymakers, efficiency in the opportunity recognition process can be further improved and strengthened through interactions with weak tie network beyond the specific industry such as different markets or institutions, or associations. Educators and trainers must be careful in differentiating the various needs of the entrepreneur at different stages of the entrepreneurial process. In the early stages of identifying the opportunities, the loosely held network ties would be fruitful in sparking the ideation of the entrepreneur. However, once the entrepreneurial journey enters the stage beyond creativity into the crystallization of business, mentors would be a more effective agent to improve the effectiveness of the entrepreneur and to increase the success rate of the start-up.

This study also contributes towards the theoretical understanding of the opportunity recognition process. The findings point to the need for future studies to delineate the opportunity recognition process with alertness as a cognitive component and opportunity recognition as the outcome component. Further clarification of opportunities that are recognized and those that are to be exploited should be further examined. The role of alertness as the cognitive component of the entrepreneur's schemata has been established in the opportunity recognition process. Within the technology industry, the drive for innovative market solutions highlights the need for a loose networking environment.

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Mathematics and Technology Integrated Education in Malaysia

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ABSTRACT

The goals of the mathematics curriculum reform are: to provide basic mathematics content for future university students studying the natural sciences, secure mathematics teaching time to develop mathematical creativity in communication and problem solving and solve individual differences in learning mathematics. By necessity, the Ministry of Educational (MOE) reformed the national curriculum for elementary, middle and high schools in 2017. The goals of this reform are to identify the similarities and differences between the national, district, school and individual levels, to promote learners' autonomy and creativity, to establish education with schools, teachers, students and parents, to develop school educational plans and to keep and manage their quality in achievement. Based on the goals, the 2017 mathematics curriculum has been developed. In the newest reform, the authors describe the directions of the new curriculum and the circumstances of mathematics pre-university level students in Malaysia.

Keywords: technology integrated, mathematics education, university students, mathematics achievement

INTRODUCTION

It is said that the education should be the one hundred year plan. To establish a nation, education should be established. When the education is well established, the nation keeps the peace. Recently, every nation tried to reform its national curriculum to keep its education system. Malaysia is not an exception. Since 1956, Malaysia's national curriculum through the Ministry of Educational (MOE) has tried to reform the national curriculum to nurture creative and talented students, to establish internal stability in mathematics education, and to realize school mathematic goals. In 2015, the MOE addressed the outline of the national curriculum and is developing the details of the mathematics curriculum. The MOE also made an effort to promote the education of technology integrated. In the newest reform, the authors describe the directions of the new curriculum and the circumstances of foundation education in Malaysia.

MALAYSIA NATIONAL CURRICULUM OF MATHEMATICS

The goals of the mathematics curriculum reform are: to provide basic mathematics content for future university students studying the natural sciences, for securing mathematics teaching time to develop mathematical creativity in communication and problem solving and to solve individual differences in learning mathematics. By necessity, the MOE reformed the national curriculum for elementary, middle and high schools in 2017. The goals of this reform are to identify the similarities and differences between the national, district, school and individual levels, to promote learners autonomy and creativity, to establish education with schools, teachers, students and parents, to develop school educational plans and to keep and manage their quality. Based on the goals, the 2017 mathematics curriculum has been developed with some guidelines.

(1) An emphasis on mathematical creativity.
(2) An emphasis on the student's humanity in mathematics education.
(3) Reinforcing the mathematical process.
(4) An application of the technology exposure groups.

The Emphasis on Mathematical Creativity

The curriculum revised the definition of a technology integrated from a skill-based aided to a creative aided, which shed new light on advanced education. In the future, a technology-integrated person is required to have creative abilities for finding new things. For developing creative abilities, we need to create a psychologically and intellectually stimulating educational environment. The 2017 reformed curriculum emphasizes promoting mathematical creativity. The meaning of mathematical creativity is the ability to produce various, original problem-solving methods while doing mathematical tasks, or to explore and construct knowledge from a new point of view.

In school, mathematical creativity is revealed during the process of analyzing, connecting and synthesizing prior knowledge and by experiencing meaningful methods using mathematical reasoning and insight. Also, when learners develop mathematical creativity in school, mathematical communication and expression related to creative thinking have to be developed as well. Creativity can also foster problem-solving skills, reasoning and communication in mathematics.

The Reinforcement of the Mathematical Process

The mathematical process is the activated mathematical ability that occurs during problem-solving. Comparing the mathematical process to the mathematical content prescribed to students, the process in school mathematics can be treated clearly. So the mathematical process is described concretely comparing to the current curriculum in teaching-learning methods.

The Application of the Technology Exposure Group

To avoid the rigidity of organizing and managing the curriculum, the technology exposure group is applied to organize and manage the curriculum flexibly through connection and cooperation between the groups. There are 2 groups (control group and expose group). The application of the technology exposure groups allows learning by different levels and allows making various knowledge skills. The application of the technology exposure groups admits the difference of the learning level, so when learners understand fast, they learn more when they understand slowly, they focus more on fundamental content. Also because the content is presented synthetically, it is possible that various knowledge reorganized the related content can be eliminated.

A TREND OF MALAYSIA EDUCATION FOR TECHNOLOGY INTEGRATED WITH MATHEMATICS

According to the 2017 Trends in International Math and Science Study (TIMSS), Malaysia's ranking in Math demolishes from 20th in 2007 to 26th in 2017. In the recently released 2015 Programme for International Student Assessment (PISA) report published, Malaysia was ranked 52nd out of 65 countries. Malaysia attained a reading score of only 398, significantly lower than the average point of 396 and a drop from the previous score of 414 achieved in the previous PISA 2014 report. In Mathematics, Malaysia did increase from the previous assessment with 412 points (compared to 404 in 2014), although this is still below the average score of 421 points. Given the challenges of the twenty-first century and other changing needs, teaching and learning strategies that have been identified include Computer-Aided Learning/Instruction (CAL/CAI). In Malaysia, a technology integrated student is defined as a student with an outstanding aided who needs special education to develop his or her potential.

Learning mathematics is compulsory for all students in Malaysia, especially for the pre-university level to further their study in a degree programme. Mathematics is important to be completed and to guarantee a good future job market. Because of technology in mathematics, introducing graphing

calculator (GC) can make the intangible interactively understanding that can be reached by students substantively enlarged.

Introducing technology in mathematics is expected to motivate students and to help them see the important linkages between mathematics and the real world. On the other hand, this study will demonstrate to educators and researchers on how technology can motivate students with learning mathematics to reach their full potential. While education for the technology integrated students was focused on mathematics and science in the past years, it now has expanded into many areas including invention, information, English, literature, fine art, music, etc. This paper will focus mainly on the mathematics education for GC-aided on pre-university level students.

Selection of GC-aided Students

A mathematics test with GC is conducted with Foundation Science student intakes of 2011/2012 and 2012/2013. The questions are designed and adapted from several sets of questions equivalent to the mathematics syllabus of pre-university level for science students. The study set consist of a collection of information studies related to student demographics, family background, educational background, experience with GC and attitude towards mathematics through four approaches; belief, effort, self-efficacy and GC attitude (Kharuddin, A. F., Azid, N., Mustafa, Z., Kamari, M. N., Ibrahim, K. F. K., & Kharuddin, D., 2020).

Consequently, these data will be analyzed to identify predictor factors for students' achievement on given mathematics tests. The numbers of science students who enrolled in June 2011 and June 2012 are 2,072 pax. These students were registered according to their course of study in unequal numbers. To conduct statistical tests, students were randomly selected through a stratified sampling method based on the number of different courses.

METHODOLOGY

A total of 800 students were chosen based on the available list and separated into two groups. The first group is the control group (CG) and the seconds the exposed group (EG). Both are to consist of 400 students. These two groups will follow a different mathematics workshop but will sit for the same set of tests. For CG, students will study mathematics syllabus related to graphing techniques through traditional methods while the EG will be exposed to the use of GC to answer all mathematics exercises through a method called new technology in teaching technique. Upon completion of the mathematics workshops held in stages over two hours, the students were given a week to review independently and students from the EG were allowed to discover and explore the use of GC.

A total of 763 students successfully grouped to pursue the mathematics with GC test. All of the students were allowed to use the GC to complete a mathematics test in one hour period. Then, the students have distributed a set of questionnaires to obtain information as well as the rate of student assessment on attitudes toward mathematics.

The hypothesis model explored examines whether the relationships between student's technological exposure (Group) and mathematics score (mathematics achievement with GC-aided) is significant or not (refer to Figure 1).

Figure 1: A Correlation Framework between Technology Exposure and Mathematics Achievement

This section of the study indicates the statistical procedures that were used to test the hypothesis. The relationship between the level of measurement and the appropriateness of data analysis is

important to make sure the existence of technical and conceptual interaction. Students have started an instrumental genesis when they try to use a new technology device for the first time.
A simple regression test is used to assess whether there is a statistically significant difference between the group performances. Each participant has occupied a specific mathematics course test named Math 1 and Math 2 before entering a workshop and sit for post-test to assess achievement. Is there a statistically significant gain in achievement from the control group score to expose group scores?

Hypothesis Test

H_0: the observed distribution fits the normal

H_a: the observed distribution does not fit the normal distribution

Initially, the dependent variable, mathematics score with GC aided (MSGA) was a continuous observed variable. By using a normality test, the data distribution of this study is substantially negatively skewed for MSGA (see Appendix A). Based on Shapiro-Wilks[1] statistical test, the dependent variable (MSGA) in this study was not normally distributed because of value is not close to 0 and significant value is less than 0.05.
Then, the data is needed to be transformed into a Standardized Zscore by using a transformation method (Tabachnick and Fidell, 2007 and Howell et al, 2009) to assume for normality. A new dependent variable name called Standardized Mathematics Achievement With GC-Aided or SMAWGA (zscore) was introduced for the next analysis.
A simple regression analysis was conducted to investigate how well technology exposure predicts standardized math score with GC-aided. The direction of the correlation was positive (0.834), which means that students who have been exposed to graphing calculators tend to have higher math scores and vice versa (see Figure 2 and Table 1 & 2). The results were statistically significant ($F = 1738.618$, $p < 0.05$) and r^2 indicate that approximately 69.6% of the variance in SMAWGA (zscore) can be predicted from technology exposure (Cohen, 1992). As a result, technology exposure had a positive relationship with SMAWGA (O'Dwyer et al, 2005).

Figure 2: A Correlation Test Result between Technology Exposure and SMAWGA

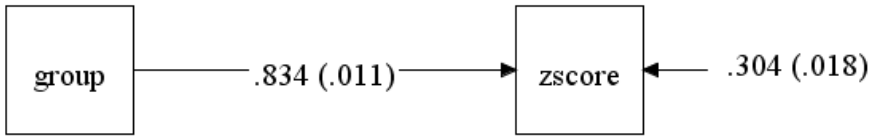

Table 1: A simple Regression Test between Technology Exposure and SMAWGA

STDYX Standardization	Two-Tailed			
	Estimate	S.E.	Est./S.E.	P-Value
ZSCORE ON				
GROUP	0.834	0.011	75.669	0.000
INTERCEPTS				
ZSCORE	-2.505	0.056	-44.969	0.000
RESIDUAL VARIANCE				
ZSCORE	0.304	0.018	16.560	0.000
R-SQUARE				
ZSCORE	0.696	0.018	37.834	0.000

[1] For tests on samples of n = 3 to 2000 use Shapiro-Wilks; for those of n > 2000 use Kolmogorov-Smirnov

Table 2: ANOVA Test between Technology Exposure and SMAWGA

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	530.011	1	530.011	1738.614	.000[b]
	Residual	231.989	761	.305		
	Total	762.000	762			
a. Dependent Variable: Zscore: Total test mark						
b. Predictors: (Constant), Group						

This study has shown that the use of GC improvised math achievement and subsequently promotes positive attitudes towards technology (GC) in doing and learning mathematics. The fact that students were able to complete the problem in worksheet with GC-emulator even though they had not gone through a proper training session on GC was encouraging. Seemingly this paper supports that it is feasible to incorporate technology in learning mathematics using the improvised GC exposure approach for under-prepared students in technology. In other words students in an exam-oriented environment or in institutions where there is a shortage of computer lab, time constraint, lack of resources or infrastructure to receive proper training can still benefit richly from the use of mathematics analysis tools (graphics calculator) complemented with proper design of instructional materials.

THE MISSION OF GC-AIDED EDUCATION: EXCELLENCE AND EQUITY

When we speak of equity, it must be agreed that having equal opportunity does not mean having the same opportunity. Equity means making experiences available that are uniquely appropriate for each individual. A Van Tassel-Baska (1997) state, equity is present when all students have equal access to potential opportunities based on reasonable standards of competence. Offering a skilled musician and a brilliant scientist the same experience is not equity; equity is offering them equal opportunities to pursue their paths toward excellence. Kharuddin, A. F., & Ismail, N. A. (2017) reminds us, excellence for all, if it means the same standards, same curriculum, same instructional emphases, becomes inequitable for all since it fails to recognize individual differences.

What should be changed in the future for GC-aided learners?

a) Differentiating the standard curriculum for GC-aided students
   More and more educators seem to be convinced that differentiating the standard curriculum is the key to the effective education of GC-aided students.
b) Graphing calculator and Differentiating curriculum for GC-aided students
   How can we use Graphing calculator to develop differentiating curriculum for GC-aided students? First, we can use Graphing calculator to accelerate the GC-aided students' current status.

$$f(x) = ax^2, f(x) = ax^2 + bx, f(x) = ax^2 + bx + c$$

   For example, GC-aided student can be asked to explore the properties of graphs.
   Second, students using graphing technology have verified a better understanding of functions and variables and accomplished better in solving algebra problems in applied contexts and interpreting graphs.
   Third, technology that supports multiple representations is shown to increase students' use of visualization in problem solving and gains in understanding.

$$(x + y)^2, (x + y)^3, (x + y)^4, \ldots$$

   Example: Evaluate a higher degree polynomial problem.

Fourth, if GC-aided student uses GC, they can explore many mathematics topics which they are interested in. The appropriate practice of GC is shown to afford all students at various levels greater access to complex mathematical concepts.

$$(x+1)^4 = 1x^4 + 4x^3 + 6x^2 + 4x + 1$$

Example: Expand to see a relationship with Binomial Expansion. Find the patterns among numbers in rows and columns in Binomial Expansion.

CONCLUSION AND DISCUSSION

The Malaysian national curriculum of mathematics is well established through plentiful reforms since 1956. Changing the society of Malaysia, creative people are needed to make new things. So, the MOE emphasizes mathematical creativity and also humanity in mathematics education. Now some mathematical research organizations are developing new mathematics curriculums, applying mathematical creativity and humanity. The mathematics syllabi are more focused on daily life situations and more focused on fun. They reduce the mathematical content and try to support the internal stability of mathematical education. Fostering mathematics education and mathematical creativity, technology integrated students are tested by observation and experiment. The programs for GC-aided students are various. With the knowledge and skills, they can search-related information, adapt, modify and innovate in deduce alternatives and solutions upon faced with future changes and challenges. The Mathematics Curriculum is frequently seen as consisting of numerous separate and distinct fields related to measurement, geometry, algebra and problem-solving.

However, to further avoid this and separate learning of their concept and skill, mathematics is linked to daily life and experiences, whether in or outside of learning institutes. Students have the opportunity to relate mathematics in different contexts and see its relevance in daily life. Giving opinion and solving problems either oral or written, students is also coached to use correct mathematical language and character. Students are trained to choose the presented information in a mathematical language such as translating and presenting information in table forms, graphs, diagrams, equations or non-equation and further present clear and accurate information, without veering from the original meaning. Meanwhile, technology in education is seen as an advantage especially in supporting achievement in the desired results of learning.

Technology being used in teaching and learning mathematics such as calculators should be seen as tools that enrich the teaching and learning process and not to replace teachers. Likewise, the beauty of mathematics is also emphasized. Introducing students to the history of famous mathematicians or important mathematical events in the past may motivate students to appreciate the subject in a long term. Mathematics' intrinsic value especially in systematic, accurate, overall, dedicated and confident thinking applied indirectly or continuously during the teaching and learning process contribute to personal building and nurturing of a positive attitude towards mathematics. Besides, good values are also introduced in the teaching and learning context. Assessments are performed to measure student achievements in tests and examinations as well as other sources which all provide useful information regarding student development and growth. Continuous and daily assessment enables the determination of student strengths and weaknesses as well as the effectiveness of teaching activities. The information gained from answers, group works and home works also help improve the teaching process and then help to enable effective teaching preparation.

Declaration of Conflicting Interests

We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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A study on Covid-19 towards Employees Mental Health

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ABSTRACT

The research identifies the negative impact of COVID-19 on an individual's mental health. Stressors include perception of safety, threat and risk of contagion, infobesity versus the unknown, quarantine and confinement, stigma and social exclusion as well as financial loss and job insecurity. Furthermore, three dimensions of moderating factors have been identified: organizational, institutional and individual factors. A total of 642 working adults have involved in this study conveniently in Selangor, Malaysia. In addition, a list of recommendations has been presented to mitigate the impact of COVID-19 on the employee's mental health, during and after the outbreak, from a human resource management perspective.

1.0 Introduction

On March 11, 2020, the World Health Organization (WHO) declared coronavirus (COVID-19) a pandemic, a global disease outbreak threatening the whole planet. COVID-19 is an infectious disease caused by coronavirus. 'Coronaviruses (CoV) are a large family of viruses that cause illness ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV). A novel coronavirus (nCoV) is a new strain that has not been previously identified in humans.' (WHO, 2020a). They are transmitted between animals and humans. They include fever, dry cough, shortness of breath and breathing difficulties, tiredness with possible symptoms of aches and pains, nasal congestion, runny nose, sore throat or diarrhea (WHO, 2020a)
Faced with this epidemiological catastrophe, individuals have presented anxiety-related behaviours, translated into a significant shortage of sanitisers, medical masks and toilet paper. This suggests that the coronavirus is not only a physical health risk, but it also weighs heavily on the mental health of individuals. The objectives of this paper are to examine COVID-19 impact on employees' mental health in organizations.

2.0 Research objective and its significant of study

Even before Covid-19, certain features contribute to an employees' mental illness, the Covid-19 is no doubt added to this issue. Uncertain prognoses, looming severe shortages of resources for testing and treatment and for protecting responders and health care providers from infection, the imposition of unfamiliar public health measures that infringe on personal freedoms, large and growing financial losses, and conflicting messages from authorities are among the major stressors

that undoubtedly will contribute to widespread emotional distress and increased risk for psychiatric illness associated with Covid-19.
Public health emergencies may affect the health, safety, and well-being of both individuals (causing, for example, insecurity, confusion, emotional isolation, and stigma) and communities (owing to economic loss, work and school closures, inadequate resources for medical response, and deficient distribution of necessities). These effects may translate into a range of emotional reactions (such as distress or psychiatric conditions), unhealthy behaviours (such as excessive substance use), and non-compliance with public health directives (such as home confinement and vaccination) in people who contract the disease and in the general population. Extensive research in disaster mental health has established that emotional distress is ubiquitous in affected populations — a finding certain to be echoed in populations affected by the Covid-19 pandemic.
In this paper examine two mental health outcomes: psychological distress and major depression that can result from a pandemic or an epidemic outbreak and how managers can reduce the risks.
The objectives of this research are to:

- Investigate whether there is a positive link between Covid-19 and employees' mental illness
- Examine the effect of occupational role impact on the potency of the stressors
- Create a bridge between epidemiology, psychology and human resource management

3.0 Research Method

A pandemic influenza question module was developed to determine each person's reaction towards the stressors. The methodology includes questions on health behaviours, health status, mental health conditions, as well as the demographics of the respondents and the households. The target sample is any working adult. Stressors include perception of safety, threat and risk of contagion, infobesity versus the unknown, quarantine and confinement, stigma and social exclusion as well as financial loss and job insecurity.
The pandemic influenza survey consists of questions regarding how employees cope up with stress in the entire Covid-19 period. The first section of the survey asked questions regarding the demographic characteristic of the respondents. The second part of the survey is the subject of this papers, asking question regarding how each type of stressors has more impact on the respondent, it calculates all the 5 stressors mentioned above towards the respondents. All responses were coded on a five-point Likert-scale, where 1 meant "strongly disagree" and 5 meant "strongly agree". The third part is a GAD-7, PHQ-9 scaling method used to analyze the respondents' stress level.
The IES is used to measure the psychological response to traumatic stressors. It is a self-reported 17-item questionnaire. Scores 60 are high. The IES subscale shows high consistency. Test–re-test for the total score was r=0.93 over a 1-week interval. Correlations were fair to moderate, but statistically significant with measures such as the Mississippi scale (MS) and the Minnesota Multiphasic Personality Inventory Post-Traumatic Stress Disorder scale (Horowitz et al, 1979). The IES has 92.3% sensitivity and 64.2% specificity. In this study, an IES score ≥60 indicates the presence of post-traumatic stress symptoms (Neal et al, 1994). The questionnaire aims to collect respondents' changes in life priorities and ways of coping. This self-reported questionnaire, which had not gone through a reliability or validity check, was developed because there were none available to specifically measure changes in life priorities and coping. It has 17 items on a 5-point scale, ranging from strongly disagree to strongly agree. It consists of two subscales: one looking at the changes in life priorities resulting from Covid-19 and the other finding out what coping methods are used to handle the emotional stress caused by Covid-19.
The Patient Health Questionnaire 9-item depression scale (PHQ-9) and 7-item Generalized Anxiety Disorder scale (GAD-7) are among the best validated and most commonly used depression and anxiety measures, respectively. They have been used in hundreds of research studies, incorporated into numerous clinical practice guidelines, and adopted by a variety of medical and mental health care practice settings. In our research, we adopted GAD-7 and PHQ-9 to examine the conditions of mental health.

The PHQ-9 and GAD-7 are standardized measures used to monitor clinical outcomes as part of Efficacy's Clinical Governance strategy. These are increasingly used in robust mental health research to indicate a diagnosis, a classification of severity and outcome monitoring within national CBT therapy services. The GAD-7 is a measurement for Anxiety Disorders and the PHQ-9 is a measurement for depression. The PHQ-9 and GAD-7 are designed to facilitate the recognition for depressive disorders and anxiety disorders respectively. These are the national standard measures routinely used by GP's, therapists and psychiatrists as screening tools.
All analyses were performed using SPSS 11.0 (SPSS Inc, Illinois). Descriptive of the IES, GAD and PHQ scores were presented using mean (standard deviation) range and median. A factor analysis was performed to cluster the coping strategies and life's priorities during the Covid-19 situation. Finally, logistic regression analysis was performed to determine predictors (the reduced factors for the coping strategies and changes in priorities determined from the factor analysis) indicative of severe psychiatric symptoms or post-traumatic stress disorder. Statistical significance was set at $P<0.05$.

4.0 Results

The survey received a total of 642 participants, with an average of (32.82±6.41) years old, 136 male participants(21.18%), 506 female participants(78.81%), among them 205(31.93) with working experience less than 5 years, 325(50.62%) more than 5 years, and 112(17.45) more than 10 years working experience. As for their education level, 125(19.47%) master and above, 284(44.24%) undergraduates, 233(36.29%) diploma and below.
The test result shows 29.44% have encountered anxiety while 36.45% have depression. Working experience, education levels, the stress level and current personal health would affect the participant's mental health, there is statistical significance in the difference ($P>0.05$).

Table 1: Participants' Demographic Data and Mental Conditions

	Sample N=642	Anxiety (GAD-7 >4)			Depression (PHQ-9>4)		
		Count	x^2	P	Count	x^2	P
Gender			0.414	0.520		0.082	0.774
Male	136(21.18)	37(27.21)			51(37.5)		
Female	506(78.81)	162(30.03)			183(36.17)		
Age			0.996	0.608		2.109	
18-25	43(6.70)	15(34.88)			0.348		
26-45	563(87.69)	162(28.77)			20(45.51)		
46-65	36(5.61)	12(33.33)			202(35.87)		
					12(33.33)		
Working Experience			21.044			18.021	0.000
Junior<5 years	205(31.93)	0.000			59(28.78)		
Senior>5 years	325(50.62)	40(19.51)			116(35.69)		
Expert>10 years	112(17.45)	100(30.77)			59(52.58)		
		49(43.75)					
Education Level			9.000	0.011		9.306	
Master and above	125(19.47)	26(20.80)			0.000		
Undergraduate	284(44.24)	80(28.17)			31(24.80)		
Diploma and below	233(36.29)	83(25.62)			109(38.38)		
					94(40.34)		
Stress Level (Reflect of Stressors in Scores)			86.087			56.551	0.000
		0.000					
	56(8.72)				7(12.50)		
Not worry(<20)	342(53.27)	4(7.14)			96(29.07)		
Slightly worry(21-	58(9.03)	69(20.18)			29(50.00)		

35)		23(39.66)		
Moderately worry (36-45)	121(18.85)	48(39.67)	64(52.89)	
Really worry (46-55)	65(10.12)	45(69.23)	38(58.46)	
Extremely worry (>56)				
Health Status		41.233	43.601	0.000
Good	545(84.89)	0.000	171(31.38)	
Normal	89(13.86)	134(24.59)	56(62.92)	
Deteriorate	6(0.93)	50(56.18)	6(100.00)	
Bad	2(0.31)	4(66.67)	1(50.00)	
		1(50.00)		

Note: the comparison of Stress Level and Demographic Data, 1. Anxiety measures P<0.05, 2. Depression measures P<0.05

The anxiety was mostly due to the stressors caused by Covid-19 and their current health status, while their working experience is the buffer (P<0.05). The education level has no connection with the anxiety measures (Table 2). Stressors due to Covid-19 and health status(P<0.05) is the main cause of depression, with the working experience as the buffer (P<0.05). The educational level has no significant connection with the depression measures (Table3).

Table 2: Logistic Regression for Binary Outcomes (Anxiety)

Method	B	SE	Wald	OR	P	95%CI
Working Experience			12.63		0.002	
(1)	-1.01	0.28	12.62	0.37	0.005	0.21~0.64
(2)	-0.54	0.25	4.64	0.59	0.031	0.36~0.95
Stress Level	0.62	0.08	59.26	1.86	0.000	1.59~4.36
Health Status	1.04	0.22	22.67	2.84	0.000	1.85~4.36

Note: Using Working Experience, Expert as reference, creating 2 dummy variables, (1): Junior =1, Non Junior = 0, (2): Senior = 1, Non Senior = 0

Table 3: Logistic Regression for Binary Outcomes (Depression)

Method	B	SE	Wald	OR	P	95%CI
Working Experience			11.93		0.003	
(1)	-0.86	0.26	10.92	0.37	0.001	0.25~0.70
(2)	-0.70	0.24	8.66	0.42	0.003	0.31~0.79
Stress Level	0.47	0.08	38.62	0.50	0.000	1.38~1.85
Health Status	1.15	0.23	26.00	3.16	0.000	2.03~4.91

Note: Using Working Experience, Expert as reference, creating 2 dummy variables, (1): Junior =1, Non Junior = 0, (2): Senior = 1, Non Senior = 0

The hypothesis in this study focus on the relationship between stressors (independent variable) and employees' mental condition. In the model, employees' mental health is the dependent variable and their working experience is the mediator. All these variables were measured by the working adults' responses. Each structural path of the model represents a possible relationship between the two variables and can be analyzed for significance. The path coefficient may be considered equivalent to a regression coefficient (β) and measures the unidirectional relationship between two constructs.

As shown by the tables, under Covid-19 the public has been tested with anxiety 29.44% and depression 36.45%.

The finding indicates a significant impact of the stressors to the employees. In addition to the biological health and safety of the general population as well as health care professionals, a stream of research has also addressed potential threats to the mental/psychological health and domestic safety challenges posed by the COVID-19 crisis. It is clear that psychological well-being and physical safety are intrinsically interconnected and cannot be reasonably categorized as fully separate safety dimensions. Severe depression and anxiety can lead to self-harm and even suicide and domestic violence, which all affect the physical well-being of individuals. Nevertheless, the focus of studies in this stream is on the indirect mental health impacts of this global epidemic rather than the biological and clinical aspects.

Disease outbreaks not only disrupt basic life activities and impede economic growth; they can also elicit both acute and long-term effects on individuals' well-being. In other words, the toll on individuals is not just physical and financial, but emotional as well. Many studies have consistently found relationships between the occurrence of infectious disease outbreaks and a host of psychological and behavioural consequences. Among the negative psychological consequences that have been most frequently reported are greater incidence of depression and psychological distress, worry, functional impairment, anxiety about being infected, and reduced quality of life (and subjective well-being.

In terms of behavioural consequences, exposure to outbreaks also resulted in preventive behaviours such as improved hygienic practices, seeking medical assistance and engaging in social distancing and isolation. The above psychological and behavioural consequences are experienced by the broader workforce but perhaps more acutely by essential workers. In studies focusing on health care workers, they often report concerns about the (non) availability of personal protective equipment (PPE), personal safety, vaccine availability, caregiving responsibilities at home, and prioritizing the well-being of family members.

Psychological distress also occurs as a result of mitigation strategies (e.g., social distancing, home containment, and travel restrictions) aimed to prevent the spread of the disease. For example, in a study of health care workers in a treatment facility during the SARS outbreak, Maunder et al. (2003) reported incidents of professional isolation arising from the use of protective masks and observance of non-physical contact with coworkers reduced morale among health care workers, and refusal to work among administrative and professional staff. Bai et al. (2004) investigated reactions of health care workers and professional staff shortly after 57 health care workers were quarantined due to the SARS epidemic. Results revealed that 20% of the participants reported feeling stigmatized, ostracized and rejected in their neighbourhoods due to their hospital work, while 9% expressed reluctance to return to work or had thoughts of quitting their job. Beyond those in the health care sector, in response to disease outbreaks, individuals in many organizations and industries have to endure harsh workplace conditions such as limited availability of social and work support, increased work demands, irregular work hours, inadequate work benefits, and poor access to healthcare.

These challenging work conditions often increase general health complaints such as fatigue, upset stomach, sleeping difficulties and headaches. Additionally, school closures and suspension of religious activities arising from social distancing measures further exacerbated these adverse psychological difficulties and contributed to serious financial strain. Taken as a whole, these studies suggest that disease outbreaks can have pervasive consequences for mental health and well-being across the workforce.

The finding of the study indicates the partial moderating effect of working experiences towards the relationship between stressors and mental health. This is possibly due to the higher working experience the more stress the employees are bearing, thus bringing pressure to perform in the workplace. Employees who start to feel the "pressure to perform" can get caught in a downward spiral of increasing effort to meet rising expectations with no increase in job satisfaction. The relentless requirement to work at optimum performance takes its toll in job dissatisfaction, employee turnover, reduced efficiency, illness and even death.

5.0 Conclusion

Having a perceived sense of control reduced perceived risk and available social support were important in the health and wellbeing of the staff during the Covid-19 crisis. Hence, clear directives and disease information, as well as being able to ventilate and voice their concerns, are important in empowering staff and in turn, improving their ability to cope. Making all protective measures to all employees did not just protect them physically – it made them feel safer. The sense of control and the perceived risk level appears to be the actual determinants of emotional impact, despite the actual risk level.

Employees in a safe and supportive environment feel better and are healthier, which in turn leads to reduced absenteeism, enhanced motivation, improved productivity and a positive organization's image. The prevention of occupational accidents and diseases, the promotion of healthy working life and the building of a preventive culture is a shared responsibility of governments, employers and workers, health professionals and societies as a whole.

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