

Managing students' mental health: The use of NGT and FDM to generate a concrete solution



 **Ramlan Mustapha^{1*}**
Tengku Nazatul Shima Tengku Paris²
Maziah Mahmud³
Mohamad Sahizam Musa⁴
Azniza Ahmad Zaini⁵
Jazimin Zakaria⁶

¹Academy of Contemporary Islamic Studies, Universiti Teknologi MARA Pahang, Raub Campus, Malaysia.

²Email: ramlan@uitm.edu.my

²Academy of Language Studies, Universiti Teknologi MARA Pahang, Raub Campus, Malaysia.

³Email: tnshima@uitm.edu.my

³Academy of Contemporary Islamic Studies, Universiti Teknologi MARA Pahang, Jengka Campus, Malaysia.

⁴Email: maziahmahmud@uitm.edu.my

⁴Faculty of Science Administrative and Policy Studies, Universiti Teknologi MARA Pahang, Raub Campus, Malaysia.

⁵Email: msahizam@uitm.edu.my

⁶Email: jazim668@uitm.edu.my

⁶Faculty of Business and Management, Universiti Teknologi MARA Pahang, Raub Campus, Malaysia.

⁶Email: nizazaini@uitm.edu.my



(+ Corresponding author)

ABSTRACT

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The impact of steps to minimize transmission of COVID-19 has increased awareness of the importance of addressing the worsening mental health of students in higher education as a matter of public policy. Supporting students' mental health and preventing mental illness requires an evidence-based understanding of the elements that affect students' mental health. Therefore, the primary purpose of this research is to find effective ways to improve students' mental health in higher education. The Design and Development Research (DDR) methodology was used for this investigation. The first part of the research involves the Nominal group technique to present ideas for a solution, and the second part involves how to implement those ideas. While the Fuzzy Delphi technique is used in the second stage of element/solution validation. The participants in both stages of the study were experts in the field who met the researcher's criteria for inclusion. According to the results, seven concrete solutions can be taken to improve students' mental health. At the end of the research, conclusions and suggestions for further research are proposed.

Contribution/ Originality: This study is seen as very significant considering that previous studies only involved survey and exploratory studies. however, this study focuses on expert opinions and all the solutions obtained are more precise, complete and accurate because they result from the expert's view.

1. INTRODUCTION

The 2019 new coronavirus disease, also known as COVID-19, has had an unprecedented impact on countries all over the world, and as a result, people are struggling to understand the risks involved. To lessen the severity of the illnesses and the number of deaths caused by the virus, numerous initiatives relating to public health have been carried out in many countries throughout the world. After effectively bringing the curve to a flattening with measures such

as social isolation, quarantine, and closure of public areas including schools, countries are finally emerging out of lockdown with cautious hope. However, although this period of the epidemic has passed, the difficulties associated with the impact on the mental health of students is continuing.

Substance abuse and mental health issues are major sources of stress for those affected. 1–3 Young adulthood is a pivotal time for the emergence of a wide range of behavioural health issues, such as GAD (generalized anxiety disorder), MD (major depression), and substance abuse disorders (Kessler et al., 2005). Undergraduate students have been the subject of numerous studies that examine the frequency of substance abuse and mental health issues (Ketchen Lipson, Gaddis, Heinze, Beck, & Eisenberg, 2015). Despite the fact that the average age of a graduate student is similar to the age of onset for many mental health disorders, our knowledge of the prevalence and risk factors associated with mental health difficulties among graduate students is limited (Allen et al., 2022). From the point of view of a student currently enrolled in higher education, the study examines the primary concerns regarding the mental health of higher education students in the wake of the COVID-19 pandemic and provides suggestions on how those concerns can be addressed realistically based on expert opinion.

1.1. Mental Illness Among Higher Education Students

Most higher education students are prone of acquiring the mental disorder. Seventy-five per cent of those with mental illness experience their first symptoms before their mid-twenties (Kessler & Wang, 2008). For most mental health issues, the onset age is between 18 and 25. The majority of higher education students (almost 80%) are young adults (Brown, 2016). In addition, suicide ranks as the second leading cause of death among young people globally (World Health Organization, 2013).

Few reliable statistics exist on the incidence of mental illness among college students. Most data sources also fail to provide adequate definitions of the terms they use (Pilgrim, 2008). For instance, 8 out of 10 students reported experiencing mental health issues in the preceding year, according to a well-publicised poll conducted in 2015 by the National Union of Students (NUS), however, the survey provided no context for the survey's definition of mental health concerns. Eight out of ten students scored themselves as less than "mentally very well," although this is hardly as startling as the statistic might lead one to believe (Brown, 2016).

In 2013, the NUS Mental Distress Survey featured a higher sample size and more transparent methodology. Ten percent of the student body disclosed having a mental health diagnosis this time around. Also, 1 in 10 students diagnosed themselves with a mental disease like depression, schizophrenia, or anxiety in a 2016 poll conducted by Unite. Nearly a third of students (32%) said they 'always' or 'often' felt 'sad or depressed' in the preceding four weeks, while 30% said they 'always' or 'often' felt 'isolated or lonely' (Neale, Piggott, Hansom, & Fagence, 2016).

Under normal conditions, college students experience elevated levels of psychological discomfort and the ensuing unfavorable academic outcomes (American College Health Association, 2019). Tertiary institutions have moved to an emergency online learning format due to physical distancing measures enacted in reaction to COVID-19, which is likely to add to students' already considerable academic pressures. Research into the effects of academic disruptions on students (Wickens, 2011) suggests that these actions may lead to a decrease in academic motivation, an increase in the demand for independent study, the forsaking of regular study habits, and even an increase in the frequency with which students choose to withdraw from school. As such, the COVID-19 pandemic has placed an unprecedented psychological burden on students, necessitating further investigation and immediate intervention. This is because the pandemic is increasing academic stressors in a population with elevated levels of pre-existing stress and a potentially reduced ability to rely on typical coping strategies (Greenhow & Chapman, 2020).

1.2. Does COVID-19 Impact Higher Education Students' Mental Illness?

Instagram, Facebook, WhatsApp, Snapchat, Reddit, and TikTok have all been inundated with COVID-19 content over the past few months (Greenhow & Chapman, 2020). Because of the "likes" and "shares," information can quickly

go viral on these platforms, leaving young people vulnerable to the risks associated with believing false information. Anxiety, helplessness, and exaggerated reactions to problems have all been connected to the infodemic spreading through social media. Even more concerning is the fact that the prevalence of COVID-19-themed jokes and memes on social media raises both the risk of infection and the potential for associated anguish and trauma because the seriousness of pandemic challenges is diminished (Thakur, 2020). Helping adolescents develop positive coping mechanisms and information-seeking habits is a team effort that benefits everyone involved (parents, teachers, counsellors, etc.). The majority of today's adolescents spend more time than ever in front of screens due to the proliferation of social media and the shift from conventional forms of schooling to digital mediums. A lack of sleep, a sedentary lifestyle, and emotional and physical health problems are all linked to too much time spent in front of a screen (Wiederhold, 2020).

Adolescents' mental health is being negatively impacted by the uncertainty of the epidemic, as well as their fear of contracting the virus, their inability to sleep, and their anxiety about the future. Adolescents have been reported to experience a rise in the prevalence of mental health issues such as stress disorders, sadness, anxiety, and substance addiction during a pandemic (Fegert, Vitiello, Plener, & Clemens, 2020). Mental health issues are already more likely during a COVID-19 pandemic because of quarantine, stress, and loss. Adolescents are left to fend for themselves in an underfunded, stigmatised field because of a lack of sufficient support mechanisms. Risks can be reduced with the help of family and community resources aimed at fostering healthier interactions with children and adolescents, as well as the involvement of child protection services if needed (Thakur, 2020).

1.3. Study Aims

This study aims to generate a concrete solution for mental health among higher education students. specifically, this study has 2 main objectives:

- To examine the views and recommendations of experts in generating a solution based on expert consensus.
- To validate the item proposed solutions based on the consensus and opinion of experts.

2. METHODOLOGY

This study uses the Nominal Group technique and Interpretive structural modelling. In the first phase of the study, the researcher will come up with a way to solve mental well-being problems using the brainstorming method (NGT). then a verification session by the experts involved in this phase one. Once the elements have been verified in the first session, the second phase will involve the use of (FDM) (Fuzzy Delphi Method) to verify the elements and solutions obtained through the first phase.

Researchers hold NGT and FDM meetings online via Google Meet due to the impossibility of assembling professionals in person at present. It was a four-hour-long meeting. To create ideas and solutions based on expert opinion, a group of experts was gathered and the NGT approach was employed in conjunction with the Fuzzy Delphi technique. At the session's end, the researcher used the NGT & FDM method to calculate a specific number to collect information relevant to the aims of the study.

2.1. Sampling

Seven Psychology professionals will serve as the initial sample for the study (first phase), and a second group of seven will be employed for item/solution validation (Second Phase).

There is substantial debate about what constitutes an appropriate sample size for studies employing NGT methods (first phase). Depending on the needs of the study, NGT may be conducted on a single cohort or large group (Lomax & McLeman, 1984; Mustapha et al., 2022) or it may be broken down into smaller groups to provide more in-depth discussions. The following sample sizes, as used by earlier researchers, are shown in Table 1:

Table 1. Nominal group technique sampling.

NGT sampling author	Sample
Andre L Delbecq and Van de Ven (1971)	5 – 9 Experts/Participants
Horton (1980)	7 – 10 Experts/Participants
Harvey and Holmes (2012)	6 – 12 Experts/Participants
Ahmad, Hussin, Yusof, and Jamil (2017)	7 – 10 Experts/Participants
Carney, McIntosh, and Worth (1996)	Min. 6 Experts/Participants

However, for the NGT phase, the researcher decided to use only 9 experts because this size is enough to carry out this method alongside time constraints and the problem of finding experts in this pandemic era is quite difficult to implement. The researcher employed the Fuzzy Delphi Method during the second stage (verifying the item/solution proposed in the first phase). As an innovative approach to soliciting knowledgeable opinions for a certain decision, this study was selected for inclusion. In the first phase of the research process, the researcher will do a literature study and get expert opinions on how to best go about creating model constructs and items. After that, the researcher will create a Fuzzy Delphi Method expert questionnaire to verify the item and solution build. Seven specialists worked on this part of the project. Experts are chosen according to the standards set for those who are competent to carry out FDM treatments. In this study, we apply a method called "purposeful sampling." When the researcher has to have everyone on the same page, this approach works well. The best approach to use when doing FDM, it is argued, is a method of purposeful sampling (Hasson, Keeney, & McKenna, 2000). In the meantime, seven specialists were called in to aid in this probe. These experts were hand-picked because of their extensive expertise and experience in their fields. The required number of specialists is 5-10 if those who participated in this inquiry are consistent. Assuming some degree of consistency, Adler and Ziglio (1996) state that 10–15 experts are the optimal number for using the Delphi method (homogeneous).

2.2. Expert Criteria

Booker and McNamara (2004) state that experts are knowledgeable people who have attained their level of expertise by a combination of classroom study, practical application, and independent study. Professionals are recognised as specialists when their peers and superiors recognise their expertise and competence based on their education, training, and experience (Mustapha & Darusalam, 2017; Nikolopoulos, 2004). Any person who has demonstrated superior knowledge in a particular field or area is considered an expert (Cantrill, Sibbald, & Buetow, 1996). The use of experts in the field is an important part of any Fuzzy Delphi study.

2.3. Nominal Group Technique

NGT is a methodological procedure for determining the consensus among a group of people with regard to concerning a given issue. It was first conceptualised as a "participation technique for social planning circumstances" (Delbecq, Van De Ven, & Gustafson, 1975) with "social planning situations" including exploratory research, public engagement, the use of interdisciplinary specialists, and the examination of proposals. Since then, it's been utilised in many different kinds of group situations, including social science empirical research. O'Neil and Jackson (1983); Lomax and McLeman (1984); MacPhail (2001) are just a few of the researchers who have used it in education, but it seems to be utilised more frequently in health research.

NGT is a highly structured process that includes four distinct phases: (1) Independent generation of ideas in response to a stimulus question. (2) Sharing (and listing) these ideas in round robin mode without discussion. (3) Clarification of each idea and grouping of similar ideas. (4) Individual voting to prioritize ideas.

To encourage honest results and engagement, voting should be anonymous and follow the guidelines outlined above. Finally, NGT provides a permanent record of the group's process and outcomes by writing down all suggestions and approved changes on flipchart pages. Displaying these papers is an excellent method to inform people

who missed all or part of a meeting, and it also allows groups to pick off right where they left off at the previous meeting (Fox, 1989; Mustapha et al., 2022).

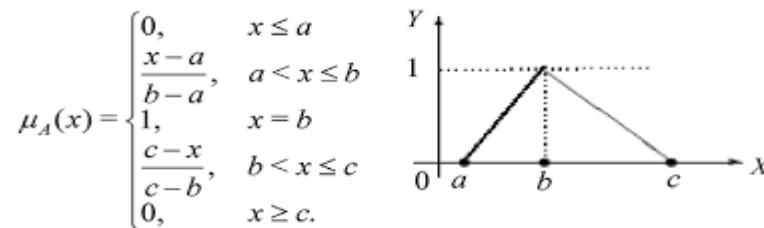
2.4. Fuzzy Delphi Method

The Delphi Method (DM) has evolved and been refined since its original creation by Dalkey and Helmer (1963). Conversely, the Fuzzy Delphi Method (FDM) is an improved and expanded variant of the traditional Delphi approach. The Delphi method uses probability theory rather than mathematical principles to deal with fuzziness in decision-making, which is where FDM and the Delphi method diverge. As a result, Fuzzy DM (FDM) has been proposed based on the integration of fuzzy theory and conventional DM to take into account individuals' linguistic preferences in the decision-making process (Hsu, Lee, & Kreng, 2010).

Instead, the FDM was created by merging fuzzy theory and the traditional DM. One of the earliest works on the application of FDM for forecasting is the study published in (Kaufmann & Gupta, 1988) while the concept of integrating the classical DM and the fuzzy theory to improve the vagueness of the DM was proposed by Murray, Pipino, and Van Gigch (1985); Mustapha and Darusalam (2022). To foresee the rise of computers, the theory was expanded to include FDM, as well as max-min and fuzzy integration algorithms (Ishikawa et al., 1993; Mustapha & Darusalam, 2022). Additionally, weights were included in the FDM variant to highlight differences in expert expertise and ability (Garai, 2013). The iterative process can be stabilised by employing a novel variation of FDM that uses fuzzy statistics and one that fits the continuous mathematically explicit membership functions (Chang, Hsu, & Chang, 2011).

Step In Fuzzy Delphi Method:

1. Choosing a reliable expert: Seven experts were consulted in total for this probe. An expert panel was convened to evaluate the linguistic variables' usefulness in determining the importance of the assessment criteria on the variables to be assessed.
2. Fuzzy triangle numbers are used to represent all linguistic factors in this determination process (triangle fuzzy numbers). At this stage, fuzzy numbers are also integrated into linguistic variables (Hsieh, Lu, & Tzeng, 2004). The triangular fuzzy number is the representation of M1, M2 and M3 (m1, m2, m3). For any given situation, m1 is the absolute minimum, m2 is a reasonable middle ground, and m3 is the maximum. Triangular fuzzy numbers are used to build the fuzzy scale, which is then used to convert linguistic variables into fuzzy numbers



3. When the researcher obtains a response from the selected specialist, he or she must convert all Likert scales to fuzzy scales in order to determine linguistic variables and average responses. In other words, we are averaging the responses of all fuzzy numbers (Benitez, Martín, & Román, 2007).
4. Methods for calculating the critical value of "d" Setting a threshold value to measure the level of consensus among experts is essential (Thomaidis, Nikitakos, & Dounias, 2006). Distances between fuzzy numbers can be computed using the following formulas:

$$d(\bar{m}, \bar{n}) = \sqrt{\frac{1}{3} [(m1 - n1)^2 + (m2 - n2)^2 + (m3 - n3)^2]}$$

- Find the alpha threshold for fuzzy summation: When all of the experts agree on a fuzzy number to rate each item (Mustapha & Darusalam, 2017). Fuzzy values are calculated and determined using the following formula: $(A_{max} = 4m_1 + 2m_2 + m_3)$
- In the process of defuzzification, the formula $A_{max} = (1/4)(a_1 + 2a_m + a_3)$ is used. If a study employs Average Fuzzy Numbers or average responses, the final score will be between 0 and 1 (Mustapha & Darusalam, 2017, 2022). There are three equations involved in this approach:

The first formula is $A = 1/3 * (m_1 + m_2 + m_3)$, the second is $A = 1/4 * (m_1 + 2m_2 + m_3)$, and the third is $A = 1/6 * (m_1 + 4m_2 + m_3)$. worth of a shave the median is zero, so we'll round up to one, and say that $(-cut) = (0 + 1) / 2 = 0.5$. If the A value is less than the $-cut$ value = 0.5, the item is rejected because there is insufficient expert agreement. The alpha cut-value proposed by Bodjanova (2006) should be more than 0.5.

$$x^* = \frac{\sum_{i=1}^n x_i \mu(x_i)}{\sum_{i=1}^n \mu(x_i)}$$

- Ranking: Prioritization is achieved using a ranking system wherein elements are selected based on defuzzification values determined by widespread agreement amongst experts, with the most important location being assigned to the item with the highest value (Fortemps & Roubens, 1996).

3. FINDINGS

Problems related to mental health among students are very critical at this point. Various solutions have been proposed by experts and psychologists related to this issue. In this study, the researcher tries to propose some solutions that can be done to overcome this problem. We started with a brainstorming session to find a solution using the NGT technique. After a brainstorming session is run to get expert views, a voting process is carried out to validate the results (First phase result). The findings of this study are as follows:

Table 2. Result from NGT-PLUS analysis.

Item/Solution	Voting value								Total item score	% Of agreement		Rank	Result
The use of self-help practices in increasing resiliency among high school students	4	5	5	4	5	5	4	4	5	41	**91.11	3	Accept
Creating peer-support networks (Buddy system):	5	5	4	4	4	4	3	5	5	39	**86.67	5	Accept
Leverage information and communication technologies to aid mental health	4	5	5	3	5	5	4	5	4	40	**88.89	4	Accept
Collaborative partnerships	5	5	5	3	5	5	5	5	5	43	**95.56	1	Accept
Consistent help from the government's resources	4	5	5	5	5	3	5	3	4	39	**86.67	5	Accept
University action plans	5	4	5	4	5	5	4	5	5	42	**93.33	2	Accept
Care obligation	4	5	5	5	5	3	5	4	4	40	**88.89	4	Accept

Note: ** Percentage of agreement (>70%).

Table 2 shows the aggregate agreement and assessment ratings for the model. All model construct concentrations are within the optimal range, as determined by this analysis. Given the findings of these studies, the percentage must now be more than 70%. The results of the analysis made, expert approval data show that all items exceed 70% expert consensus. Deslandes, Mendes, Pires, and Campos (2010) and Mustapha et al. (2022) are only a

few examples of research that support this notion. This allows the researchers to conclude that the core features of the model are workable and well-received by the target population. The modified NGT technique is a time-saving alternative to the lengthy rounds of expert judgement required by the Delphi method.

Table 3. The NGT result for solution.

No of the item	Solution	Details
1	The use of self-help practises in increasing resiliency among high school students	Adolescents' mental health will be negatively affected in the short and long term, thus it's important to help them cope with the situation. To help students develop resilience, teachers might encourage them to set short-term objectives and schedules and instruct them in mindfulness practices. Helping those in need through volunteer work or other acts of gratitude and compassion can also be quite effective.
2	Creating peer-support networks (Buddy system):	Through network hubs or mentorship supports, such as those formed by teenagers already connected to each other (e.g., sports clubs, hobby clubs), or assisted by youth organisations, high school students are able to make peer relationships and check in on peers.
3	Leverage information and communication technologies to aid mental health	Exploring online portals that provide resource centres and self-assessment tools allows high school pupils to access digital options for support and resources. More and more people will be able to get the support they need for their mental health without leaving home, thanks to advancements in self-help applications, digital therapy, and telemedicine services.
4	Collaborative partnerships	Community mental health groups need to collaborate with high school students, their families, and their schools to develop programmes that promote positive mental health. Because of the COVID-19 epidemic, we are now able to stay in constant contact with one another and work together on projects like community mindfulness workshops.
5	Consistent help from the government's resources	As high school students, we believe that increased coordination between regional, provincial, and federal governments is necessary to effectively mobilise and invest in community resources that encourage youth group participation.
6	University action plans	All colleges and universities must have a documented policy regarding mental health. Also, future action plans need to be mapped out in great detail. A growing number of colleges and universities are implementing programmes to aid students' mental health, and these institutions can share best practices by learning from one another. After that, you need to make a plan of action, carry it out, evaluate its effectiveness, and either update it or start over.
7	Care obligation	In many cases, universities would not provide any services to a student who has been suspended. The institution should have a proper care plan in place if a suspended student is experiencing mental health issues, especially if the student has not informed their parents or guardians of their struggles.

The results of the NGT analysis also (see Table 3), the reviewer formulates several solutions that may be taken from the expert opinion. There are 7 concrete solutions following the priorities based on university and experts such as 1) The use of self-help practices in increasing resilience among high school students 2.) Creating peer-support networks (buddy systems) 3) Leverage information and communication technologies to aid mental health 4)

Collaborative partnerships 5) Consistent help from the government's resources 6) University action plans 7) Care Obligation.

Next, the researcher made an evaluation and expert agreement for the solution that resulted from the NGT session. In both phases, the researcher used the Fuzzy Delphi Method to verify this solution. The results are as follows:

Table 4. Result of FDM analysis from FUDELO (Fuzzy Delphi logic software).

Expert no	Item 1	Item 2	Item 3	Item4	Item5	Item6	Item7	
Expert1	0.049	0.049	0.033	0.091	0.025	0.033	0.025	
Expert2	0.008	0.280	0.033	0.198	0.082	0.025	0.025	
Expert3	0.008	0.049	0.025	0.091	0.025	0.025	0.033	
Expert4	0.049	0.066	0.025	0.033	0.025	0.025	0.025	
Expert5	0.124	0.066	0.033	0.033	0.322	0.033	0.033	
Expert6	0.049	0.124	0.025	0.082	0.082	0.033	0.033	
Expert7	0.008	0.124	0.025	0.033	0.082	0.025	0.025	
Value of the item		0.042	0.108	0.028	0.080	0.092	0.028	0.028
Value of the d construct		* 0.058						
Item < 0.2		7	6	7	7	6	7	7
% Of item < 0.2		100%	85%	100%	100%	85%	100%	100%
Average of % consensus		** 95%						
***Defuzzification (Alpha-cut)		0.914	0.785	0.957	0.842	0.857	0.957	0.957
Ranking		2	5	1	4	3	1	1
Status of agreement		Accept	Accept	Accept	Accept	Accept	Accept	Accept

Note: * Average of d Item: < 0.2.
 ** Average Agreement: > 75%.
 ***Alpha-cut > 0.5.

By statistical measures, the threshold value of darkness is greater than 0.2 (> 0.2). (see Table 4). There are two schools of thought among experts, and they just cannot agree on anything. When all model components are averaged together, we get a threshold value (d) of 0.2, or 0.123; this value must be less than 0.20 for an item to have a strong expert agreement (Chang et al., 2011; Cheng & Siow, 2018). Overall, 95% of experts agree on this, which is more than the minimum criterion of 75% required for consensus. Most defuzzification outcomes with Alpha-Cut are greater > = 0.50. If the alpha cut value is less than 0.5, as suggested by Sun, Chen, Tang, and Wu (2010) it should be removed. Evidence suggests that mental well-being solutions have been well-received by experts. Based on the defuzzification value (alpha-cut) see Table 4, the priority of the solution proposed by the experts is arranged according to priority (see Figure 1).

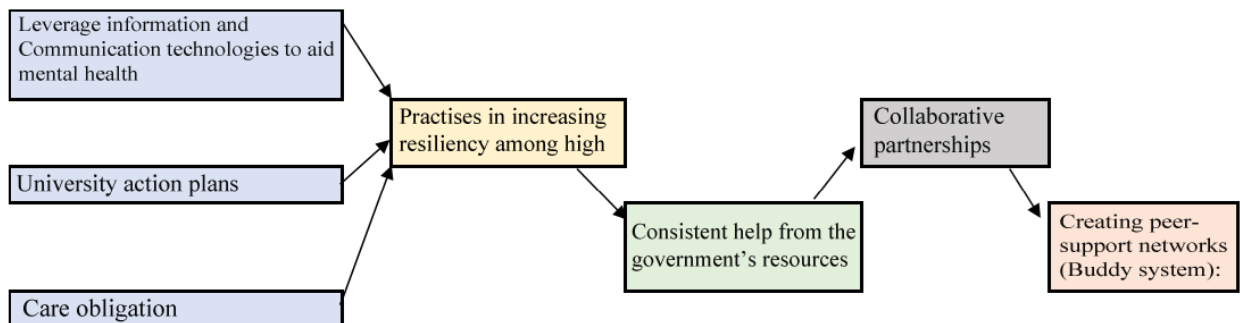


Figure 1. Ranking priority level of solution based on FDM analysis.

4. DISCUSSION AND CONCLUSION

Overcoming mental health problems among students is not an easy thing. Various initiatives have been implemented by various stakeholders in solving this problem. However, mental health-related problems remain high

now. Reactive services alone cannot successfully support student mental health and well-being (Hughes & Spanner, 2019) given the growth in mental health problems among students and the surge in the demand for formal support (Worsley, Pennington, & Corcoran, 2022). Institutions of higher learning have come to realise the need to expand beyond conventional means of aid to supply students with more easily accessible interventions aimed at boosting their emotional and psychological well-being. For this reason, these schools are in a prime position to detect, prevent, and treat students' mental health issues, as they touch on so many facets of their life. Despite the availability of programmes meant to boost students' emotional health and general well-being, there has not been a comprehensive synthesis of the evidence supporting their efficacy.

Based on this endless constraint and improvement, the researcher tries to find a solution to this problem based on expert opinion using the most appropriate method, which is NGT and FDM based on expert opinion. The result is some opinions that the researcher can formulate, namely, the interested parties need to make leverage of information and communication technologies to aid the mental health, the stake holder have to create specific actions plans and care Obligation. These three aspects are in the list of main importance of the results of the analysis that has been made by the researcher. In addition, stakeholders also need to mobilize practices in increasing resiliency among higher education students. In addition, the government needs to help and provide the necessary resources consistently so that all programs can be implemented properly. This aspect is in the second and third levels of importance. Finally, programs such as Collaborative partnerships and peer support programs need to be encouraged and established so that effective planning to eradicate mental health problems can be implemented properly.

5. LIMITATION AND FURTHER RESEARCH

This study has various limitations that remain. First, this study focuses on expert opinions in providing possible solutions that can be used to deal with mental health problems. Future researchers may use other methods that are felt to contribute to a better and more concrete solution. Second, the experts involved in this study are only experts known to the researcher and in the environment of university lecturers only. But in the future studies can use other experts such as psychologists, psychiatrists who work in hospitals and also experts from abroad. Third, this study, study focused on proposed solutions, but future studies can build clinical modules or interventions so that concrete solutions can be well-proven.

6. IMPLICATION

Given the foregoing, future primary and review-level research must pay close attention to how treatments affect different segments of the population, such as those defined by socioeconomic status, gender, ethnicity, age, sexual orientation, and disability. There are additional intersections between these demographic factors that need to be taken into account. Religious and cultural upbringings could also play a role. Some therapies showed promise of effects sustained post-intervention, therefore future studies should also investigate the latency and durability of effects over time. This can involve looking into research that compares outcomes before and after an intervention, as well as studies that examine the results of follow-up sessions.

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