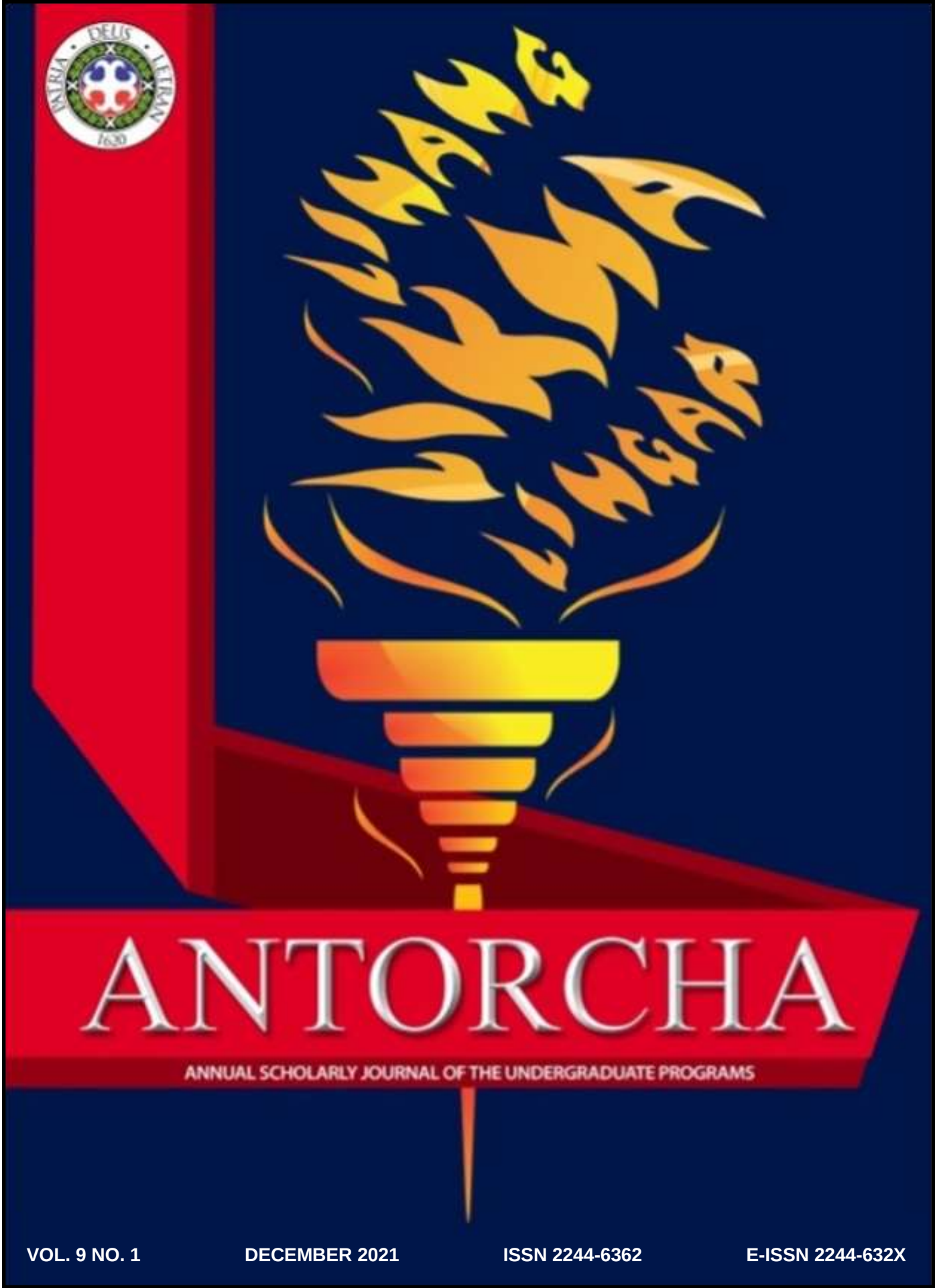

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BIG FIVE PERSONALITY TRAITS AS FACTORS INFLUENCING VIDEO CONFERENCING FATIGUE AMONG WORK FROM HOME OFFICE WORKERS

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ABSTRACT

Video Conferences became a big part not only in school settings but also in the industrial and organizational field of work when this COVID-19 pandemic started. This study aims to determine the influence of the big five personality trait's Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism towards video conferencing fatigue among work from home workers. Using a non-probability sampling technique, specifically, purposive sampling, a total of 111 work-from-home office employees participated in the study and employed a descriptive correlational design. The results suggest that the domain Neuroticism has a significant positive correlation with Video Conference Fatigue with the use of Pearson's r correlation. However, Extraversion, Agreeableness, Conscientiousness, and Openness is not significantly related with the outcome variable. These findings suggest that consistent with the literature, those individuals with high in Neuroticism tend to report more fatigue and with the current study, a higher video conferencing fatigue.

Keywords: personality, work from home, videoconferencing

INTRODUCTION

As people navigated into the new normal due to the COVID-19 pandemic, everything shifted to an online setting wherein video conferencing became the new platform for communications especially at work. Hence, "video conferencing went from a novelty to a necessity" causing its usage to increase due to people staying at home and not allowed to go out all over the world, but although video conferencing is digital one can still experience exhaustion (Fauville, 2020). Working from home with the use of computers or teleworking shows impact to the employees since it changes the way people work. (Sardeshmukh, et al., 2012). In addition, the study of Fauville, et. al. (2020) proved that frequency, duration, and packed meetings intensify video conferencing fatigue. According to Langvik, et al., (2019), being able to understand the connection of fatigue and personalities among workers is important as it helps organizations to immediately identify potential threats in work productivity among their employees. Hence, the researchers will seek to know if the big five personality factors have influence in the video conferencing fatigue.

Video Conferencing Fatigue

The term video conferencing fatigue ("Zoom Fatigue") was coined as a result of the increased usage of "Zoom," which is the most commonly used video conferencing app with a reported around 300 million regular meetings since the pandemic lockdown began in April 2020 and continues to expand still.and the construct of video conferencing fatigue

is now defined by (Fauville, et al., 2021; Iqbal, 2020) as "feeling of exhaustion from participating in video conference calls". A study conducted by Bennett A., Campion E., Keeler K., and Keener S., (2021) tested the validity of video conferencing fatigue (zoom fatigue) as a construct and it was confirmed by 92.9% of the participants in their qualitative survey. Moreover, a study by Fauville, G., Luo, M., Queiroz, A. C. M., Bailenson, J. N. and Hancock, J. (2021) seek factors that affects video conferencing fatigue have found that video conferencing fatigue (Zoom fatigue) increased with frequency, duration of meetings, and burstiness (i.e., shorter time in between various meetings) and that women experienced more fatigue than men, even after controlling for differences in usage of the app, demographics and personality types like introversion and extraversion.

Video conferencing as a form of computer mediated communications (CMC), have a variety of purposes such as tools for collaboration, saving time, and minimizing travel-related stress which can be very helpful during this time of pandemic to stay socially connected (Nguyen, et al., 2021). It was also considered that working from home with the use of a computer is beneficial since it reduces the time pressure and time-related stress of the employees since they do not need to stress about the travel time into work (Sardeshmukh, et al., 2012). However, it is not assured that video conferencing is fully beneficial for the employees, according to Denstadli, Julsrud, & Hjorthol (2012), in their study on Norweigian business travellers a lot of business travellers use face to face (FTF) meetings rather than video conferencing (VC) since it provide opportunities for developing new business connections and informal conversations, but according to the authors, VC and FTF meetings can be more beneficial to be used complementarily, since many face to face meetings probably cannot be replaced by video conferencing, and vice versa. Sardeshmukh, et al., (2012) on the other hand says that video conferencing is beneficial since it reduces the time pressure and time-related stress of the employees since they do not need to stress about the travel time into work, however, that assumption is not assured that video conferencing is fully beneficial for the employees. With video conferencing being widely used as a mode of communication in the workplace during the pandemic, fatigue is the number one complaint of employees, and digital technology is seen to be the cause presented in the study of Dol, K., (2016), that computer-related tasks (like video conferencing) cause high visual and motor demands, like frequent usage cause eye fatigue to its users. Furthermore, Bennett A., Campion E., Keeler K., and Keener S., (2021) studied the changes in fatigue after video conference meetings during Covid-19, and it was found that it is not video conference itself that affects fatigue, but it is when video conference occurs for instance. The study suggests that video conference fatigue can harm employee well-being, however, results have found that there are aspects like group belongingness, use of mute features, and time of day that can alter the likelihood of fatigue.

Recent studies have explored different factors on what influences the likelihood of fatigue especially at work, in a study conducted by Dol K., (2016) supported the preliminary assumption that computer related tasks cause high visual and motor demands, like for instance frequent usage cause eye fatigue to its users, they found that the key regions of pain are the neck, shoulders, and waist. In addition, the self-reported fatigue scores increased with the amount of internet use, this implies that the pain levels and the fatigue of the participants increased in relation to the duration of their internet use per day. On the other hand, Gultom S., Endriani D., Harahapa A., (2020) correlated these mental and physical fatigue with age of computer users, and found that elderly employee group, so was the younger employee group, was both having physical and mental fatigue when performing computer related tasks. This implies that age is not the factor for the employees experiencing fatigue when using computers. Furthermore, the results from the study of Bolliger & Halupa (2020) tested the technology fatigue of faculty in higher education and negated the results from previous studies. Their results indicated that their participants reported relatively low and moderate levels of technology fatigue and perhaps the instructors do not experience high levels of fatigue because they noted that technology use is all over in our society and workplaces, which means that they were used to it, participants also disagreed that they feel tired of using technology. This was supported by the study of Johnson D., et. al., (2018) who found that fatigue was not dependent on physical energy that is exerted, or perceived work demands at work, but it was related to perceived control over work and perceived reward associated. These findings on control and reward as a predictor of fatigue is consistent with the motivational control theory of Hockey (2011).

Big Five Personality

Recent studies have found that personality traits Openness, Extraversion, and Neuroticism can affect workplace stressors like burnout either positively or negatively. A study conducted by Kashyap, N. & Sharma, A. (2017) have found that open-minded people (individuals high

in openness) can be expected not to be easily emotionally exhausted, since the assumption is that they are adjustable and adaptable to new situations which implies that Openness may be associated with lesser stress, and with extraversion, emotional exhaustion is negatively correlated with male and female samples, this can be because of high self-confidence and dominance and optimism of highly extroverted individuals. On the other hand, Maylor, S. (2017) argued that individuals high in Neuroticism experienced less or reduced feelings of personal accomplishment and it was found that Neuroticism was the only trait that showed a correlation with all three dimensions of burnout. This were also congruent with the longitudinal study of Langvik, E., Lehouillier, I.S., & Sorengaard, T.A. (2019) which showed that neuroticism had a positive correlation with both physical and mental fatigue at Time 1 and was the only trait that could predict physical fatigue at Time 2. Moreover, the longitudinal study also showed that the personality trait Agreeableness, which is defined in the study of Abbondanzio, M., (2020), as friendliness and cooperativeness of an individual, appeared to have a negative correlation with fatigue at work, especially physical or mental fatigue, hence the personality trait Extraversion, which is a trait that is known for activeness, assertiveness, and act of sociability of a person (Abbondanzio, M., 2020), only showed a negative correlation with mental fatigue when it was measured at the same time. While the personality trait Conscientiousness, which is also known as a trait that complies with organization, efficiency, and planning, was revealed to have a positive association with emotional facets of burnout which may lead to emotional fatigue (Armon, G., Shirom, A., & Melamed, S. 2012). This is also supported by the study of Azeem, D. (2013), that Conscientiousness can significantly predict burnout among healthcare employees, but it can also help against the effects of work burnout.

Various studies on big five personality and burnout on employees also further revealed that the big five personalities to be critical on both individual and organizational performance. Big five personalities vary differently on burnout and emotional regulation depending on individuals' personality traits. In the study of Santos, Mustafa, & Chern, (2016), on personality being useful in determining whether employees are likely to experience strain by their emotion regulation, highlights that certain personality traits buffer or exacerbate the stress caused by emotion regulation. The study found that people high in conscientiousness are emotionally stable and are not susceptible to personal or work-related burn-out while extraverted ones who use deep acting emotional regulation were less likely to experience personal and work-related burnout, since extroverts are more sensitive to rewards and are likely to be more emotionally reactive. In addition, the conscientiousness trait prevents the symptoms of burnout wherein employees with high conscientiousness can cope up with the possible stress they may encounter in work. On the other hand, the study of Enwereuzor, et, al (2017) studied the moderating role of agreeableness and conscientiousness between emotional exhaustion and workplace deviance. It was found that the more agreeable and conscientious the employee is, the less likelihood for it to have workplace deviance, which implies that agreeableness and conscientiousness alters workplace deviance which also lowers emotional exhaustion.

Characteristics such as openness to certain objects and people, engagement in discourse, and openness to interpretation make up personality traits. The use of the Network for social media sites has grown in popularity, and as an outcome of this popularity, the number of social networking consumers has risen significantly in recent years. According to the surveys, in some countries the concept of social media exhaustion has indeed emerged among the users of different social media platforms, and this greatly causes their passion for digital networking to subside. Lee, C., Chou, S.T., & Huang, Y. (2014) conducted a study examining the correlation between social media fatigue and the Big Five personality, and the results showed that Big Five personality has an impact on social media fatigue. It is concluded in the study that the take of a person on social activities, functions, and contents can vary on the individual's personality traits on how long one can spend time on these sites. In line with this, according to Pflügner, Mattke, & Maier (2019) study that using information and communication technologies (ICTs) such as social medias, video conferencing apps etc. can make the individuals experience techno-stressors which can cause unproductivity and emotional exhaustion. It is highlighted in the findings that specific personality traits do not necessarily have a positive or negative influence on techno stressors but it rather depends on the combination of these big five traits if it would predispose such stress on individuals, these six different combinations of personality traits to predispose to techno-stressors are namely neurotic-agreeable (C1), neurotic-conscientious (C2), agreeable conscientious (C3), neurotic-agreeable and conscientious (C4), open-extraverted and agreeable (C5), and open-neurotic (C6).

The persistent view of studies on fatigue is that it has been caused by the exhaustion of bodily resources from carrying out work. But the Motivational Control Theory of fatigue by

Hockey (2011) supports the assumptions of recent findings on the big five personality as a predictor of fatigue at work. The Motivational Control Theory of fatigue conceptualizes fatigue as a state resulting from extended use of executive (high effort) control strategies and reflecting the conflict between current goals and alternative goals for the control of an action. It assumes that it is more likely that fatigue will turn out to be problems of cognitive control rather than with a loss of physical energy resources. By theory, Hockey (2011), postulates that fatigue is a problem of the management of control rather than of energy exertion. This means that fatigue is a result of conflict between the innate competing cognitive and behavioral tendencies of an individual like the personality, for instance. However, it is not clear in the current findings and assumptions in the literature on whether personality still constitutes fatigue in relation to work from home employees using video conferencing applications during the COVID-19 pandemic. Thus, based on the collected studies mentioned above, the researchers come up with the following hypothesis.

The researchers hypothesized that only the domain Neuroticism will show a positive correlation with video conference fatigue while the domains; Extraversion, Agreeableness, Conscientiousness, and Openness will have a negative correlation with video conference fatigue.

H1: Neuroticism has positive influence with Video Conferencing Fatigue

H2: Openness has negatively influence with Video Conferencing Fatigue

H3: Conscientiousness has negative influence with Video Conferencing Fatigue

H4: Extroversion has negative influence with Video Conferencing Fatigue

H5: Agreeableness has negative influence with Video Conferencing Fatigue

The purpose of this study is to provide additional information to the employees working from home to organizations that utilize video conferencing as means of communication for work, and to other researchers that seek supplemental information regarding the relationship of personality traits towards video conferencing fatigue, which is a very relevant topic not only for this time but also in to the future, as the world progresses and fully adapts on technological setting.

METHODOLOGY

Participants

To carry out the study, a purposive sampling technique will be used to select participants. The samples that were chosen to participate are based on the goals of the study and should qualify with the certain criteria set by the authors. In this study, the participants must be qualified in this criterion: any employees that are currently working from home, residing in the Philippines, that use video conferencing platforms such as Zoom, Skype, Google meet, MS teams and others most of the days in their work. In this way the researchers can focus on the characteristics of the participant of interest, which will best enable for conclusive results. Data gathering remotely within a short period of time, the researchers chose participants that were within the reach.

Among the 111 participants, their job positions were 17 (15.3%) Teachers, 17 (15.3 %) Customer Service Representatives, 11 (10%) BPO Worker, 9 (8.1%) Analyst, 8 (7.2 %) Manager, 4 (3.6%) Sales Associate, 2 (1.8%) Designer, 2 (1.8%) Engineer, 2 (1.8%) Financial Advisor, 2 (1.8%) Librarian, 2 (1.8%) School Admin, 2 (1.8%) Associate Program Coordinator, 2 (1.8%) Trainer, 2 (1.8%) Virtual Assistant, 2 (1.8%) Content Developer and 27 (24.3%) other positions such as English Tutor, CEO, IT, and Office Staff. See table 1.

Table 1. Job Positions of the Respondents

Job Position	Frequency	%
Teacher	17	15.3%
Customer Service Representative	17	15.3%
BPO Worker	11	10%
Analyst	9	8.1%
Manager	8	7.2%
Sales Associate	4	3.6%
Designer	2	1. 8%
Engineer	2	1.8%
Financial Advisor	2	1.8%
Librarian	2	1.8%
School Admin	2	1.8%
Associate Program Coordinator	2	1.8%
Trainer	2	1.8%
Virtual Assistant	2	1.8%
Content Developer	2	1.8%
Others (English Tutor, CEO, IT, Office Staff)	27	24.3%

**N=111

Materials

A demographic questionnaire with questions given such as age, sex, and job position, along with self-administered questionnaire that includes questions such as "What app do you use in video conferencing at work?" and "How long does the video conferencing take during your work?" will be used in the study alongside with the two research tools to measure the variables.

Zoom Exhaustion & Fatigue Scale

The Zoom Exhaustion & Fatigue Scale is a 15-item test developed in Stanford University by Fauville, et al., (2021), which measures the five dimensions of fatigue, namely: (a) general fatigue involve items such as how tired do you feel after video conferencing?, (b) social fatigue involve items such as How much do you want to be alone after video conferencing?, (c) emotional fatigue involve items such as how emotionally drained do you feel after video conferencing?, (d) visual fatigue involves items such as how blurred does your vision get after video conferencing?, and (e) motivational fatigue involve items such as how often do you feel like doing nothing after video conferencing? . Each item is scored based on a 5-point Likert scale where 1 means "not at all", 2 means "slightly", 3 means "moderately", 4 means "very", and 5 means "extremely". A summation of the scores will be obtained to assess the final Zoom Exhaustion & Fatigue Scale score that will determine the level of fatigue. A total of 114 participants took part in the development of the scale. The reliability on constructs was above .8 (general fatigue: $\alpha = .88$, visual fatigue: $\alpha = .88$, social fatigue: $\alpha = .84$, motivational fatigue: $\alpha = .83$, emotional fatigue: $\alpha = .86$), this indicates a good scale reliability. For the validity, ZEF Score was positively correlated to the three measures of video conferencing use to a higher level of fatigue is associated with having more meetings (frequency, $r(202) = .23$, $p < .005$), longer meetings [duration, $r(202) = .17$, $p < .05$], and the tendency to cluster meetings together without breaks in between [burstiness; $r(202) = .17$, $p < .05$], suggesting high convergent validity. Lastly, a confirmatory factor analysis revealed a good fit and dimensionality of the 5-factor structure in diverse adult sample: CFI = .958, TLI = .949, RMSEA = .076 and SRMR = .050, $X2 (85) = 185.17$.

Big Five Inventory-2 Short Form (BFI-2S)

The Big Five Inventory-2 Short Form (BFI-2S) with 30-item inventory developed by Sotto and John (2017) to measure the Big Five Personality domains (a.) Extraversion with an item includes "Is dominant, acts as a leader", (b.) Agreeableness with items such as "Is compassionate, has a soft heart", (c.) Conscientiousness with items such as "Is reliable, can always be counted on", (d.) Negative Emotionality with items such as "Worries a lot", and (e.) Open-mindedness with items such as "Is fascinated by art, music, or literature". It is a Likert scale type with 1 as strongly disagree to 5 as strongly agree. The authors found that the BFI-2-S retained much of the full measure's reliability and validity of the full 60 item BFI-2 scale. Their study 1 found that Congruence coefficients comparing pairs of corresponding factors across samples were at least .96. This suggests that BFI-2-S have a clear Big Five structure. The study 2, in each validation sample, part-whole correlations for the BFI-2-S averaged .95 (total range across the two samples = .94 to .97), this replicated the preliminary findings from Study 1, BFI-2-S capture approximately 91% and 80%, respectively, of the total variance in the full 60 item BFI-2 domain scales. In addition, the Alpha of the BFI-2-S domains averaged .77 or .78 (total range = .73 to .84), replicating the preliminary findings from Study 1, which means that BFI-2S retained approximately 91% of the full measure's internal consistency. Lastly, when they examined the replication of the factor loadings across the validation samples, the congruence coefficients between corresponding factors were at .97 (M = .98) for the BFI-2S. These results indicated that BFI-2 short forms have a valid and reliable measure for big five personality traits.

Procedure

The researchers conducted an online survey for data gathering with the use of Google forms, wherein the tests were administered individually to each participant using email and messaging platforms. Prior to the answering of the questionnaires, an informed consent will be presented to the participants. Participants who agreed to participate in the study will answer the demographic questionnaire which includes personal information questions such as name, age, sex, and type of job. After answering the demographic questionnaire, the participants will proceed on answering the Zoom Exhaustion and Fatigue Scale by (Fauville, 2021) to measure the level of video conferencing fatigue, followed by the Big Five Inventory-2 Short Form by (John and Soto,

2015). To assess their personality traits, in the domains such as Extraversion, Agreeableness, Conscientiousness, Negative Emotionality, and Open-mindedness. Finally, there would be a debriefing section for the researchers to address any concerns, and clarifications from the participants, via email.

Design

The study used descriptive and correlational research design to provide statistically significant findings about the video conferencing fatigue among work from home office employees. Thus, this will accurately and systematically describe the video conferencing fatigue among work from home office workers. It will seek to find what domains of the big five personality traits are influencing the video conferencing fatigue and how it is happening at work from home office employees. Jeffreys's Amazing Statistics Program or JASP, will be used to run the gathered data. A test for Correlation Coefficient will be employed to find the linear correlation between the big five personality factors and video conferencing fatigue. This will give the quick and simple summary of the direction and strength of the relationship between the variables. In addition, Multiple regression analysis will be employed to produce a regression equation where the coefficients will represent the relationship between each independent variable and the dependent variable. This would determine which big five personality factors significantly influence the likelihood of video conferencing fatigue. Hence, the results will be used to make empirical findings and conclusions of the study.

RESULTS AND DISCUSSION

The researchers hypothesized that the Big Five Personalities are factors that can influence Video conferencing fatigue. Means and Standard Deviation of Video Conferencing Fatigue with the use of Zoom Exhaustion and Fatigue (ZEF) and the Big Five Personality were as follows. The respondents scored moderately high in having video conferencing fatigue. Whilst the Big Five Personality were Agreeableness seemed to be the dominant personality among the respondents, which showed that most of the respondents are very warm and sociable people. See table 2.

Table 2. Mean and Standard Deviation of Zoom Exhaustion and Fatigue and Big Five Personality

Variables	M	SD
Video Conferencing Fatigue		
Zoom Exhaustion and fatigue (ZEF)	41.955	14.218
Big Five Personality		
Extraversion	18.099	2.892
Agreeableness	22.450	3.416
Conscientiousness	21.117	3.731
Neuroticism	17.189	4.377
Openness	19.838	2.627

**N=111

The study shows that out of the different video conferencing applications, Zoom with 66 (59.5%) is the most frequently used application, followed by MS Teams with 59 (53.2%), Google Meet, with 47 (42.3%), Skype with 23 (20.7%), and other applications with 12 (10.8%) like Webex, Chimes, and etc. See table 3.

Table 3. Different Video Conferencing Applications

Video Conferencing App	Frequency	Percentage
Google Meet	47	42.3%
Skype	23	20.7%
Zoom	66	59.5%
MS Teams	59	53.2%
Others (Webex, Chimes ...)	12	10.8%

**N=111

Most of the respondent's length of video conferencing were 1 hour with 27 (24.3%), followed by 6 hours or more with 21 (18.9%), 2 hours with 16 (14.4%), less than an hour with 16 (14.4%), 3 hours with 13 (11.7%), 4 hours with 13 (11.7%), and lastly, 5 hours with 5 (4.5%). See table 4.

Table 4. Length of Video Conferencing

Length of Video Conferencing	Frequency	Percentage
Less than an hour	16	14.4%
1 hour	27	24.3%
2 hours	16	14.4%
3 hours	13	11.7%
4 hours	13	11.7%
5 hours	5	4.5%
6 hours or more	21	18.9%

**N=111

In determining the relationship between Big Five Personality to Video conferencing fatigue, a correlation was

used as a statistical treatment for the data. The statistical treatment showed that Extraversion, Agreeableness, and Neuroticism has a positive correlation with Video Conferencing Fatigue. On the other hand, Conscientiousness and Openness has a negative correlation with video conferencing fatigue. Among the big five personality Neuroticism is the only trait to be found to have a significant relationship with video conferencing fatigue. See table 5.

Table 5. Correlation Matrix of the Big Five Personality and Zoom Exhaustion and Fatigue

Variable		ZEF	Extraversion	Agreeableness	Conscientiousness	Neuroticism	Openness
1. ZEF	Pearson's r	--					
2. Extraversion	Pearson's r	0.023	--				
3. Agreeableness	Pearson's r	0.091	0.308***	--			
4. Conscientiousness	Pearson's r	-0.045	0.309***	0.352***	--		
5. Neuroticism	Pearson's r	0.218*	-0.185	-0.129	-0.453***	--	
6. Openness	Pearson's r	-0.036	0.184	0.287**	0.230 *	-0.390***	--

**N=111, * p < .05, ** p < .01, *** p < .001

This research is conducted to determine if Extraversion, Agreeableness, Conscientiousness, Neuroticism and Openness influence video conferencing fatigue among work from home employees. It is hypothesized that the five predictor variables will be associated with video conferencing fatigue. The results show that the 6.3% of the variance is explained by the five predictors, F (5,105) = 1.422, p<.001). Specifically, Neuroticism positively correlated with video conferencing fatigue. On the other hand, Extraversion, Agreeableness, Conscientiousness, and Openness is not significantly related with the outcome variable. This suggests that those individuals with high in Neuroticism tend to report having higher video conferencing fatigue. See table 6.

Table 6. Multiple Regression Analysis with Video Conferencing Fatigue as Outcome Variable

Predictor	SE	*β*	*t*	*p*
Intercept	18.641		0.616	0.539
Extraversion	0.503	0.028	0.276	0.783
Agreeableness	0.444	0.100	0.940	0.349
Conscientiousness	0.435	0.021	0.181	0.857
Neuroticism	0.368	0.255	2.253	0.026
Openness	0.576	0.025	0.236	0.814

**R^2= .063(N = 111, p< 0.001) CI confidence interval for B

CONCLUSION

Consistent with the literature and the hypotheses of the researchers, the findings of this study shows that Neuroticism is the only personality trait that was found to have a significant influence with video conferencing fatigue. Although the present results of the study revealed that being high in Neuroticism can influence video conferencing fatigue, it was found that there is no significant relationship between the personality domains Extraversion, Openness, Conscientiousness and Agreeableness in relation to fatigue or VCF. Moreover, in utilizing the theoretical framing from the motivational control theory by Hockey (2011), which outlines and conceptualizes fatigue not in terms of energy depletion, but rather as a conflict in the "control of motivational choices of an individual'. The results became consistent with the assumption of the theory that fatigue can be a result of a conflict between the innate competing cognitive and behavioral tendencies of an individual like the personality.

Employees with high neuroticism are more susceptible with having video conferencing fatigue. It is supported by the findings of Langvik, Lehouillier & Sorengaard (2019) wherein neuroticism has a positive relationship with mental and physical fatigue and Armon, G., Shirom, A., & Melamed, S. (2012) stated that a person with high neuroticism is vulnerable to burnout and emotional exhaustion. Corresponding with Azeem (2013) study employees with neuroticism triggers burnout. In this study, it is only highlighted that employees with high levels of neuroticism can influence conferencing fatigue. Hence, employees with low neuroticism may or may not be predisposed to video conferencing fatigue. Furthermore, according to Maylor (2018) and Abbondanzio (2020) neuroticism can affect the fatigue of the employees wherein when they are high in neuroticism, they tend to experience low or decrease feeling of personal accomplishments which cause emotional exhaustion that triggers fatigue.

The results drawn from this study can help organizations who are using work from home schemes, on predicting the likelihood of their employees to experience video conferencing fatigue based on their personality trait. Moreover, this can help organizations to strategize policies and interventions for employee motivation. This would give them a deep understanding of video conference fatigue effectively mitigating its implications with the productivity of their work from home employees. Furthermore, study on this topic in the future will aid in the advancement of the video conferencing fatigue as a construct since this can raise awareness in the public needed for it to take into account for future studies.

This study has certain limitations as it only tested a small number of sample participants. Future researchers may consider selecting a specific type of job as a criterion for their participants and a much larger number of samples, for a more generalizability on future study results. In addition, future research may also gather more participants by using different sampling techniques aside from the one used in the present study. Furthermore, to have better results, future studies in this field may consider other factors such as the time of the day the work occurs, the specific type of work of an employee, and other factors that can be assumed to be a moderator of video conferencing fatigue among employees.

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COOKING PROPERTIES AND SENSORY QUALITY OF GLUTEN-FREE ADLAI (*Coix lacryma – jobi L.*) PASTA

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ABSTRACT

Adlai is an underutilized cereal for human food production despite its flour being a potential gluten-free (GF) source in the development of several foods. Thus, the aim of this research was to develop a good quality GF pasta from Adlai flour and to evaluate the cooking properties, sensory attributes, and proximate composition of the different gluten-free Adlai pasta formulations in comparison to the commercial ones. Adlai flour (AF) was mixed with pre-gelatinize cassava starch (PGCS) [AF: PGCS] to produce three (3) treatments, namely: Treatment 1 (100: 0); Treatment 2 (95:5) and Treatment 3 (90:10)]. Xanthan gum (XG: 5 % w/w) and egg white powder (EWP: 10% w/w) were added using full factorial complete randomized design to produce GF pasta. The developed pasta and the control treatment (Treatment 4) were subjected to cooking properties such as cooking time, cooking loss, and water absorption. Sensory analysis was done using 9-point hedonic scale (n=50) for the three (3) GF pasta formulation including the control (commercially available GF pasta). The results showed that the use of Adlai flour with PGCS, EWP, and XG to produce a gluten-free pasta significantly affected its cooking properties, sensory attributes, and proximate composition. Sensory evaluation indicated that Treatment 4 (brown rice pasta; control) gained the highest acceptability for all sensory attributes (like moderately) and is comparable to Treatment 3 (90:10) in terms of texture. However, scores regarding aroma have no significant difference among the different samples. In terms of the cooking properties, results showed that as the level of PGCS increased, water absorption tends to increase, whereas, cooking time and cooking loss were likely decreased. The developed GF Adlai pasta showed a great number of total energy (kcal), protein, and dietary fiber which are higher than both the commercial (non-gluten-free) pasta product and GF pasta. Moreover, compared to the commercially available GF pasta, the Adlai pasta is cost-efficient.

Keywords: Gluten-free pasta, Adlai (Coix lacryma – jobi L.), Cooking properties, Sensory evaluation

INTRODUCTION

Pasta is a popular food consumed in different countries. With its simple ingredient list, it can ease the preparation time and make it a quick food option for people around the globe (Slinkard et al., 2014). As a wheat-derived staple food with a very long shelf life, it ranked second to the bread in world consumption (Mariani-Constantini, 1988 & Madhumitha, 2011). Thus, it is a product massively consumed by the general population and at the same time, pleases even the pickiest of young eaters. It is typically made from an unleavened dough of wheat flour mixed with water or eggs, and formed into sheets or other shapes, then cooked by boiling or baking (Serventi et al., 2002). The most preferred raw material to produce pasta is durum wheat semolina. It contains gluten protein that enables proper dough formation via efficient networking of the matrix due to essential viscoelastic behaviour exhibited upon mixing with water and in further extrusion process that is also vital for the desired

quality attributes of cooked pasta. Semolina flour, however, has a limited nutritional profile and lacks the amino acids lysine and threonine (Kies and Fox,1970; Abdel-Aal and Hucl, 2002; Zhao et al., 2005). In addition, with gluten as one of its components, it possesses harmful effects for the sensitive consumers with gluten intolerance and celiac disease (Wieser and Koelher, 2007).

Since the discovery of Dicke (1950) that the ingestion of wheat was responsible for the symptoms of celiac disease and people with gluten-intolerance, numerous reviews appeared in order to meet the demand for gluten-free products such as pasta. In order to meet market demand for better gluten free products, development of gluten-free foods and beverages has acquired great importance in recent years (Sharma et al., 2015).

Pasta is known as one of the most popular carbohydrate-based food products. It is also a key element in the basic diet of most cultures and is consequently one of the most consumed foods in the world. It has a high acceptability due to its great convenience, fast preparation, as well as the satiety it provides (Charoenthaikij, 2018). However, it is traditionally made from durum wheat flour which contains gluten. This cannot be consumed by the entire population due to the fact that some individuals have a gluten-intolerance.

Gluten intolerance can cause digestive problems such as gassiness, abdominal pain, or diarrhea due to the consumption of gluten. This also involves individuals who have celiac disease which remains obscure from public concern because the symptoms are not uniquely alarming compared to other chronic diseases. These symptoms are diarrhea, weight loss, and deficiency in iron, folate, vitamin B12 and D (Woodward, 2007). Individuals with gluten-intolerance like those with celiac disease can only be treated by a complete avoidance of wheat, rye, barley, and their derivatives in the diet (Palavecino et al., 2017). There has been a rising demand for gluten-free (GF) products due to the growing number of individuals who have gluten intolerance (Bustos et al, 2015) and a growing segment of the population choosing to follow gluten-free diet for nonmedical reasons (Hager et al., 2012). However, it is difficult to produce good quality gluten-free (GF) foods such as pasta, without the technological properties provided by gluten (Green and Cellier, 2007; Sciarini et al, 2012).

Development of gluten-free pasta is a big challenge for food research and development. The network forming ability of gluten needs to be substituted by other means, in order to achieve products with satisfying quality (Schoenlechner et al., 2010). Consumer acceptance of cooked pasta is based primarily on textural properties, but unfortunately, GF pasta tends to be sticky, produces a lot of cooking residue, and has an unpleasant texture (Marti and Pagani, 2014). Thus, in order to improve these properties, ingredients from several sources are currently being investigated, such as native and modified starches, GF flours, gums, whey, and egg proteins (Kahlon et al., 2013).

Protein is one of the most important factors affecting pasta properties. It is used for building structure in solid and semi-solid foods to provide the mechanical strength and textural properties of pasta (Bruneel et al., 2010). Egg protein has multifunctional properties such as gelling, foaming and emulsifying characteristics, in addition to its high nutritional quality. It is known to improve firmness and elasticity as well as the protein content of the developed pasta (Kiosseoglou, 2003). In addition, hydrocolloids such as pre-gelatinized starch and xanthan gum can be added to improve the quality of GF pasta due to their ability to bind water. Xanthan gum has the ability to stabilize temperature, has shear thinning rheological properties, and improves firmness and mouthfeel (Sozer, 2009). Although most of the cereal flour used in the production of GF pasta are made of rice and corn with the addition of proteins, gums, and emulsifiers, there are more nutritionally valuable cereal with good textural qualities and readily available alternative crops that could contribute towards the much-needed steadiness of food supply and other resources to sustain the life of people while at the same time maintaining ecological balance. One such bio resource that has a big potential in meeting this challenge is Job's-tears (Coix lacryma-jobi-L) (Lirio et al., 2013).

Job's tear (Coix Lacryma-jobi L.), also known as Adlay/Adlai in the Philippines, is a tall grass Gluten-Free grain-bearing tropical plant of the family Poaceae. Depending on the variety, the seeds are yellow, purple, or brown and are often tear-shaped, hence, the name "Job's tears". It has been widely studied across the globe and predominantly contains carbohydrate (73.9 g), protein (12.8 g), and fat (1.0 g) with trace minerals and vitamins such as calcium (25 mg), phosphorus (43.5 mg), iron (5 mg), niacin (4.3 mg), thiamine (0.28 mg), and riboflavin (0.19 mg).; and food energy (360-380 cal/100 g). (Mulyon et al., 2019). These macronutrients (carbohydrates, protein, fat), minerals (Calcium, Phosphorus, Iron), B- vitamins (Niacin, thiamin and Riboflavin) and dietary fiber are on a higher level over rice and wheat. The major protein is coixin which is rich in proline and leucine

but is insufficient in lysine (Gupta, R., 2015). The preliminary field investigation showed that Adlai is a promising supplement to rice as staple food. It grows naturally on marginal uplands without requiring the traditional land cultivation, irrigation, fertilizer, and pest control demands of rice. The harvesting, threshing, and milling are done manually. Adlai has a low glycemic index rating of 35. Glycemic index (GI), among other indicators, measures the increase of blood sugar caused by the intake of carbohydrates. In the case of rice, both amylose and dietary fiber content were found to be inversely proportional to the GI. That means that when compared to white or brown rice, Adlai can be a great source of carbohydrates for people at risk of diabetes, obesity, and colon disorders (Trinidad & Mallilin, 2011).

Meanwhile, studies indicate that Adlai has anti-allergic, anti-mutagenic, hypolipemic, and anti-diabetic effects. It also exhibits anti-cancer activity. In a study by Hung et al. (2003), Adlai seeds were found to exert an anti-proliferative effect on human lung cancer cells in vitro and in vivo and prevent the development of tobacco carcinogen-induced tumors. The anti-cancer activity of Adlai was further proven by the study of Lee et al. (2008), who isolated five active compounds from Adlai bran that inhibit cancer cells. In traditional Chinese medicine, Adlai hull extract is used to treat dysmenorrhea and was proven in a recent study that, indeed, it is a feasible alternative therapeutic agent. Wet-milling process of Adlai flour is known to have a high viscosity, swelling and gelatinization enthalpy (Mulyono et al., 2019). Thus, Adlai flour can be a great alternative ingredient in the production of gluten-free pasta. Furthermore, this grain has nutritional, bioactive compounds, and cooking properties suitable for functional foods (Andoy et al, 2019).

This study aims to develop a good quality gluten-free pasta from Adlai flour by determining the cooking properties such as cooking time, cooking loss, and water absorption of the most acceptable treatment of the GF Adlai pasta, identifying the most acceptable treatment of GF Adlai by sensory evaluation and determining the proximate analysis (% moisture content, ash, carbohydrates, protein, fat, sugar as invert, and total dietary fiber) of the most acceptable treatment of the GF Adlai pasta.

This study will benefit the consumers, particularly individuals who have a gluten-intolerance like celiac patients as well as the growing segment of the population choosing to follow a gluten-free diet. The gluten-free Adlai pasta can also be a great source of carbohydrates for people at risk of diabetes, obesity, and colon disorders (Trinidad & Mallilin, 2011) due to its low glycemic index rating of 35. This study will also help in promoting the use of Adlai in the field of research and development and increase its demand in the market. Furthermore, the use of Adlai flour in gluten-free pasta production will be a good alternative for it is readily available and can contribute towards the much-needed steadiness of food supply and other resources to sustain the life of people while at the same time maintaining ecological balance. In addition, it has nutritional and cooking properties, and sensory qualities which are considered as functional attributes necessary for gluten-free pasta production. Thus, Adlai pasta is a potential supplement to staple food and can improve the overall diet quality of an individual.

This study focused mainly on the cooking properties, proximate composition, sensory quality, and consumer acceptability of the gluten-free Adlai pasta formulations. Further, this study will focus on the total carbohydrates, ash, moisture, protein, sugar as invert and total dietary fiber content of the most acceptable GF Adlai pasta formulation. In terms of the cooking properties, only the cooking time, water absorption, and cooking loss was undertaken. In addition, this study is limited to using only the Adlai grits and the Ginampay variety. Texture analysis will be excluded due to the unavailability of the equipment to be used for the pasta samples.

Review of Related Literature

Pasta is a cereal-based staple food, known as one of the most popular carbohydrate-based products that is consumed worldwide. It has a high acceptability, due to its great convenience, fast preparation, as well as the satiety it provides (Meena, 2019). Having originated in Asia and the Mediterranean, Italy is still most well-known for its pasta making and leads in national consumer consumption per capita (International Pasta Organization, 2011). As a wheat-derived staple food with a very long shelf life, it is second only to bread in world consumption (Mariani-Constantini, 1988; Madhumitha, 2011). The highest quality pasta is made solely from durum wheat semolina flour. This creates a product that has great rheological properties, cooking quality, and high consumer acceptance (Dexter et al., 1979).

The versatility of pasta allows it to be formed into almost any shape and size. It comes in varieties such as spaghetti,

fettuccine, macaroni, rotini, and farfalle. Pasta can be made either fresh or dried. Fresh pasta skips the drying step and allows for a much quicker process. Dried pasta, on the other hand, has a longer shelf-life than the freshly made pasta (Slinkard et al., 2014).

According to Kill (2001a), a good quality pasta is based on three crucial factors: raw material, mixing and production, and drying. Since basic pasta is made using flour and water, the use of quality flour is essential, hence, the strong preference to durum wheat. Protein is also one of the most important factors affecting pasta properties. It is used for building structure in solid and semi-solid foods to provide the mechanical strength and textural properties of pasta. Egg white protein in particular, has a multifunctional property such as gelling, foaming and emulsifying characteristics, in addition to its high nutritional quality. It is known to improve firmness and elasticity as well as the protein content of a pasta (Kiosseoglou, 2003). In addition, hydrocolloids such as pre-gelatinized starch and xanthan gum can be added to improve the quality of GF pasta due to their ability to bind water. Xanthan gum in particular has the ability to stabilize temperature, has shear thinning rheological properties and improvement of firmness and mouthfeel (Padalino et al, 2016).

The change in lifestyle, income, food preferences and consciousness of consumers towards safe, nutrient-rich healthy foods has increased the demand of pasta enriched with nutrients and functional attributes and has driven researchers to develop its variants containing natural compounds like cereals (rice, corn and sorghum), minor cereals (fonio, teff, millet and job's tears) or pseudo-cereals (amaranth, buckwheat, quinoa) as reported by (Moreno, 2014). Moreover, consumption of gluten containing foods made from wheat, rye or barley is a severe problem for the persons suffering with celiac disease and gluten intolerance. Gluten intolerance can cause digestive problems such as gassiness, abdominal pain or diarrhea due to the consumption of gluten. This also involves individuals who have celiac disease which is defined as an autoimmune disease that can potentially affect any organ, not merely the gastrointestinal tract, as previously assumed. The only satisfactory treatment for celiac disease is a gluten-free diet which involves complete avoidance of wheat, rye, barley, oatmeal and their derivatives in the diet (Palavecino et al., 2017). Unfortunately, most common foods and beverages, such as bread, biscuits, pizza and pasta, are made from cereals containing gluten such as wheat. Wheat contains two proteins, glutenin and gliadin, which during mixing and kneading develop into gluten. Gluten is responsible for the protein-starch interaction that provides specific viscoelastic properties in products (Bustos et al., 2015). For such patients, gluten free products are being manufactured from.

With pasta as a key element in the basic diet of most cultures; and is consequently one of the most consumed foods in the world, with the market presence of gluten-free pasta being important for coeliac health. Development of gluten-free pasta is a big challenge for food research and development, the network forming ability of gluten needs to be substituted by other means, in order to achieve products with satisfying quality (Schoenlechner et al., 2010). Consumer acceptance of cooked pasta is based primarily on textural properties, but unfortunately, GF pasta tends to be sticky, produces a lot of cooking residue and has an unpleasant texture (Marti and Pagani 2013). Although most of the cereal flour used in the production of GF pasta are made of rice and corn with the addition of proteins, gums, and emulsifiers (Palavecino, 2017), there are more nutritionally valuable cereal with good textural qualities and readily available alternative crops that could contribute towards the much-needed steadiness of food supply and other resources to sustain the life of people while at the same time maintaining ecological balance. One such bio resource that has a big potential in meeting this challenge is Job's-tears (Coix lacryma-jobi-L) (Lirio et al., 2013).

Job's tear (Coix Lacryma-jobi L.), also known as Adlay/Adlai in the Philippines, is a tall grass, a grain-bearing tropical plant of the family Poaceae. Depending on the variety, the seeds are yellow, purple or brown and are often tearshaped; hence, the name "Job's tears". It has been widely studied across the globe and predominantly contains carbohydrate (65%), protein (15%), moisture (11%), fat (6%) with trace minerals and vitamins such as calcium, phosphorus, niacin, thiamine, and riboflavin; and food energy (360-380 kcal/100 g) (Mulyono et al., 2019). These macronutrients (carbohydrates, protein, fat), minerals (Calcium, Phosphorus, Iron), B- vitamins (Niacin, thiamin and Riboflavin) and dietary fiber are higher level over corn, rice and wheat. Job's tears flour contained 2.25% amylase. The major protein is coixin which is rich in proline and leucine but is insufficient in lysine (Gupta, 2015).

The preliminary field investigation showed that Adlai is a promising supplement to rice as staple food. It grows naturally on marginal uplands without requiring the

traditional land cultivation, irrigation, fertilizer, and pest control demands of rice. The harvesting, threshing, and milling are done manually. Adlai has a low glycemic index rating of 35. Glycemic index (GI), among other indicators, measures the increase of blood sugar caused by the intake of carbohydrates. In the case of rice, both amylose and dietary fiber content were found to be inversely proportional to the GI. That means that when compared to white or brown rice, Adlai can be a great source of carbohydrates for people at risk of diabetes, obesity, and colon disorders (Trinidad & Mallilin, 2011). Meanwhile, studies indicate that Adlai has anti-allergic, anti-mutagenic, hypolipemic, and anti-diabetic effects. It also exhibits anti-cancer activity. In a study by Hung et al. (2003), Adlai seeds were found to exert an anti-proliferative effect on human lung cancer cells in vitro and in vivo and prevent the development of tobacco carcinogen-induced tumors. The anti-cancer activity of Adlai was further proven by the study of Lee et al. (2008), who isolated five active compounds from Adlai bran that inhibit cancer cells. In traditional Chinese medicine, Adlai hull extract is used to treat dysmenorrhea and was proven in a recent study that, indeed, it is a feasible alternative therapeutic agent.

In addition, a study conducted in the School of Food Science and Engineering, Nanjing University of Finance and Economics in China, the phytochemicals profiles of three Adlai varieties, including both free and bound of total phenolic and total flavonoids, and total antioxidant activity of Adlai was determined. On average, the bound phenolic contributed 45.3% of total phenolic content of the Adlai varieties analyzed and the average values of bound flavonoids contributed 71.1% of total flavonoids of the Adlai varieties analyzed. The Adlai sample itself has no cytotoxicity (Wang et al., 2013).

Adlai (Coix Lacryma-jobi L.) originated from India and now are native to the East and Southeast Asian region in China, Japan, Myanmar, the Philippines, and Thailand. Their seeds have been used to produce food products as well as ornamental products such as rosaries and necklaces. De-hulled mature seeds can be cooked and consumed together with cooked rice. The polished and milled flour can be sometimes mixed with water and consumed as a cooling drink like barley or flour water. The pounded grain of Job's tears can also be used for brewing of beer in the Garo, Karbi and Naga tribes (Burkill, 1935). In China, they are used as traditional medicine and supplementary medicinal foods. The beneficial health effects of Adlai are: (i) reducing liver fat accumulation, (ii) protecting from tumor stimulating compounds, (iii) protecting against viral infection, (iv) reducing allergic reaction, (v) reducing coronary artery disease and arthrosclerosis, and (vi) reducing osteoporosis (Chang et al., 2003; Hung and Chang, 2003; Shih et al., 2004; Yu et al., 2011). In Thailand, after the seed coats are removed, the seeds are cooked, dried, deep fried or baked and then consumed as a snack with different flavors. The seeds are also boiled with water to produce Adlai beverage, which is available in the market as an alternative healthy cereal drink.

In the Philippines, the Department of Agriculture – Bureau of Agricultural Research (DA – BAR) is promoting the use of Adlai in the field of research and development due to its versatility and nutritional value. Adlai is known in Mindanao for it is the top grower of this crop. This crop has the ability to survive from drought and flood and can grow robustly even in the most demoted area. DA has seen the potential of this grain as a staple crop to help solve the problem of the country's chronic insufficiency as far as rice crop is concerned.

Another important characteristic of the plant is its resilient adaptability to marginal or poor soil conditions. Bansen et al. (2010) reported that "katjan" (the plant's common name) was found to tolerate and grow in a wide range of temperature, elevation, pH, organic matter and soil nutrient contents. In contrast to rice, Job's tears can grow well in upland areas with very low soil fertility and poor irrigation. Job's tears, to grow well, does not require too much attention. It needs a little care after planting and weeding may only be once or twice, therefore the expenditure for its cultivation is much more affordable to local farmers. Rice production is more dependent on cash inputs; it intensively uses labor, chemical inputs such as manufactured fertilizers and pesticides (Douangsavanh & Buoahom, 2006).

Addition of Adlai flour to substitute the wheat flour in bakery products is also of interest. A recent study in the Philippines was conducted on the utilization of Adlai flour as a composite for all-purpose flour in Saltine Crackers (Andoy et al., 2019). Recorded studies which use minimally processed Adlai in single form or combination with other grains are already performed in butter cakes and formulated rice like grains. Adlai flour was obtained after polishing and milling and can be used as a food ingredient such as pasta.

Adlai (Coix Lacryma-jobi L.) is a gluten-free grain that contains various nutrients, vitamins, and minerals, with a level higher than wheat and rice. A study conducted in Indonesia was done to determine the physical and chemical

properties of Adlai flour and was subjected to wet milling and dry milling techniques. The result showed that wet-milling process increased viscosity, swelling and gelatinization enthalpy, therefore, is recommended for producing Adlai flour (Mulyono et al., 2019). Thus, Adlai can be a great alternative ingredient in the production of gluten-free pasta. Furthermore, this grain has nutrition, antioxidants, and textural qualities suitable for functional foods (Andoyet al., 2019).

Optimization of ingredient proportion is needed to be studied as well as the knowledge of the precise influence of ingredients/additives on the cooking and textural properties of Adlai flour as an alternative base for a good quality pasta. This study aims to develop a gluten-free pasta from Adlai flour, evaluate the cooking properties, proximate composition and compare the sensory characteristics of the developed sample with the similar product available in the market through sensory evaluation, using the different pasta formulations.

The development of gluten-free Adlai pasta and the desired outcomes through the evaluation of cooking properties, proximate composition and sensory quality will be done to determine its feasibility and consumer acceptability in comparison to the ones available on the market as shown in Figure 1.

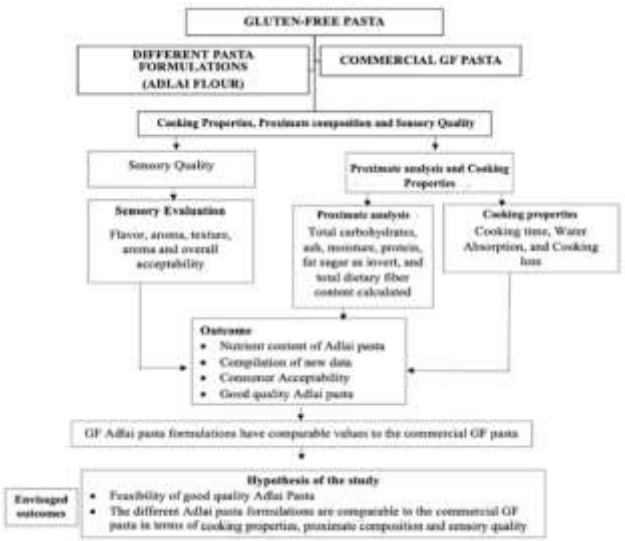

Figure 1. Conceptual Framework

METHODOLOGY

Raw Materials

The Adlai grits (Ginampay Variety) was procured at Department of Agriculture-Cagayan Valley Research Center (DA-CVRC), San Felipe, Ilagan City, Isabela. Other ingredients such as salt and oil were purchased from the local market. The following food grade ingredients were purchased from a local supplier: Xanthan Gum (XG) (Kemrad Incorporation, Quezon City, Metro Manila) Pre – Gelatinize Cassava Starch (PGCS), Egg White Powder (EWP) (Dalkem Corporation, Quezon City, Metro Manila), Brown Rice Pasta (BRP) (Healthy Options).

Processing of Adlai flour

Processing of Adlai flour was done according to the procedure of (Mulyono et al., 2019) by using the wet milling process as shown in Figure 3.1. The wet-milled Adlai flour was produced as follows: the grains were cleaned and soaked in water overnight at room temperature, with ratio grain to water (3:1 w/w), followed by milling using an Adlai hammer mill with addition of water. The wet flour was placed in the container and dried in a tray dryer at 60°C for 1 hour. The flour was then sifted twice using 100 mesh sieve and was stored in sealed-plastic bag at 4°C.

Figure 2. Production of Adlai flour from wet-milling process

Pasta Formulation and Processing

A full factorial complete randomized was used as an experimental design for the levels of the selected variables. The formulation and processing were based on the procedure of Charoenthaikij (2018) with some modifications. With a 100 g flour basis, consisting of Adlai flour (AF) mixed with pre – gelatinize cassava starch (PGCS) (AF: PGCS at 100:0 ;

95 : 5 and 90 : 10), xanthan gum (XG : 5% w/w), egg white powder (EWP : 10% w/w) and the following ingredients: salt (2%), rice bran oil (19%) and water (70-90%). The limits established by Codex Alimentarius regulation for the xanthan gum (XG) content was considered. The pasta formulations are shown in Table 1.

The raw ingredients and water were then mixed by hand to form a rough dough. Rice bran oil was added for kneading to form a smooth dough. The dough was rested and covered with a plastic wrap for 30 minutes at room temperature (28 ±2°C). After that, the dough was sheeted and cut into a length of 40 mm with a 1.5 mm thickness (fettuccini shape) using a pasta maker. The pasta was then steam-cooked using a steamer for 10 minutes and dried in a tray dryer at 60 ±5°C for 3 hours to obtain less than 10% moisture content.

Table 1. Pasta Formulation

Formula	T1	T2	T3
AF: PGCS	100:0	95:5	90:10
EWP (%)	10% w/w	10% w/w	10% w/w
XG (%)	5% w/w	5% w/w	5% w/w

Cooking Properties of Pasta

Optimal cooking time

The optimal cooking time (OCT) was determined according to AACC method no. 66-50. Ten grams of pasta were placed into a pot containing 1,000 mL of boiling water while stirring and partially covering the pot to help reduce evaporation and maintain consistent temperature. The OCT was determined by compressing a pasta sample between 2 glass slides and observing the line disappearance by taking samples at intervals of 1 min. Once the center core of pasta disappears, the cooking time is recorded.

Cooking loss

The cooking loss of pasta was determined according to the AACC2000 method no. 66-50. Five-gram pasta were cooked in 50 mL of boiling water (the ratio of pasta: water = 1: 10). Pasta samples were then cooked using optimal cooking time. Cooking loss (CL) can be determined by evaporation of the cooking water contained in a pre-weighed beaker, to constant weight at 105 °C, the residue was expressed as g of solids/100 g of raw pasta. The reported values were the average of at least two replicates for each sample.

Water absorption

The cooked product was drained for 3 minutes and weighed to determine water absorption using the following equation:

Water absorption = [(weight of cooked pasta) – (weight of raw pasta)] / (weight of raw pasta)

Sensory evaluation

The different formulations of Adlai pasta, along with the commercial brown rice pasta were carried out by 50 untrained panelists (20-50 years of age; equally divided among men and women) who have no allergies to gluten and all ingredients used in the pasta formulations. Portions of 100g of pasta were cooked in water at the time point defined previously by the cooking test. Cooked samples (5g) were provided to the testers in encoded disposable cups at a random order. The sensory attributes of the cooked gluten-free Adlai pasta were evaluated using a 9-point hedonic scale (9 = like extremely; 8 = like very much; 7 = like moderately; 6 = like slightly; 5 = neither like nor dislike; 4 = dislike slightly; 3 = dislike moderately; 2 = dislike very much; 1 = dislike extremely). Panelists were asked to evaluate sensory attributes including taste, color, texture, aroma, and general acceptability.

Proximate Analyses

The gluten free Adlai pasta that obtained the highest score in the Sensory Evaluation was sent to SGS Philippines, Inc. in Marikina City for proximate analyses. The samples were determined by the following parameters: total carbohydrates, ash, moisture, protein, sugar as invert and total dietary fiber. The Analytical Methods were based on the AOAC official.

Gluten Testing

The gluten free Adlai pasta that obtained the highest score in the Sensory Evaluation was sent to SGS Philippines, Inc. in Marikina City and was forwarded to SGS Vietnam Ltd. in Ho Chi Minh City, Vietnam for gluten testing. The 220 g Adlai pasta sample has undergone comprehensive testing for the detection of gluten Enzyme-Linked Immunosorbent Assay (ELISA) testing methodologies to determine the presence of gluten at low levels. Specifically, the AOAC

2012.01 (21st Ed., 2019) R5 sandwich ELISA method (A) was used in this study.

Statistical Analysis

The results for the Sensory Evaluation were subjected to the Analysis of Variance (ANOVA, (Kruskal-Wallis Test), while the cooking properties and the proximate composition were subjected to a one-way ANOVA. The Tukey's range test was performed for post-hoc multiple comparison. Statistically significant difference was established at $P < 0.05$.

RESULTS AND DISCUSSION

Cooking properties of GF Adlai pasta

The pasta cooking process involves a complex molecular transformation: starch swells because of contact with hot water, some granules gelatinize into the pasta structure, but others are leached to the medium along with amylose chains, causing an undesirable sticky pasta surface and turbid cooking water (Beta and Corke, 2001; Heo et al., 2014; Larrosa et al., 2016). The three-dimensional network that retains the granules in GF pasta is usually made up of proteins, pregelatinized starch and hydrocolloids (Marti and Pagani, 2013).

Table 1: Water Absorption and Cooking Loss

Treatment	Optimal Cooking Time (minutes)	Water Absorption (%)	Cooking Loss (%)
1 (100:0)	3^{b}	$115 \pm 2.83_{b}$	1^{bc}
2 (95:5)	3^{b}	75 ± 12.73^{d}	1.85^{b}
3 (90:10)	3^{b}	159 ± 9.19^{a}	1.15 ± 0.04^{bc}
4 (Control)	10^{a}	113.63 ± 8.41^{c}	8.56 ± 0.75^{a}

Optimal Cooking Time (OCT)

The optimal cooking time (OCT) of the pastas containing Adlai flour were similar (3 minutes), but they differed from the time determined for the control sample, which can be attributed to the increase in fiber content of the formulations containing Adlai flour (Gatta et al., 2017). The values reported in the present research were similar to the results observed by Gatta et al., 2017) (9min for spaghetti produced with semolina and 20% of wheat bran), but lower than those reported by Ferreira et al. (2016) (11 – 15min for gluten-free pasta developed with a mixture of sorghum–rice–corn flour and potato starch). Thus, the type of flours used for pasta production can influence its cooking time.

Water Absorption (WA)

Good cooking quality is associated with high values of water absorption (WA). WA for Adlai pasta were between 75% and 159 % (Table 2). The results showed that GF Adlai pasta samples had significant differences in WA. The WA value can be considered acceptable if it can absorb 150-200g of water/100g pasta, namely a water absorption between 150% and 200% (Bustos et al., 2015). Thus, Treatment 3 (90:10) and Treatment 1 (100:0) are considered acceptable. In particular, the addition of pregelatinized cassava starch (PGCS), egg white protein (EWP) and xanthan gum (XG) promoted high hydrophilic starchy structure and resulted in high water absorption. This indicates that as the PGCS and XG increases, the water absorption also tends to increase. However, an increase in water absorption of pasta depends on the size and shape of pasta (Martinez et al., 2016) as well as the drying and cooking process (Teba et al., 2009). Sozer, 2009 also reported that hydrocolloids can increase viscosity and improve the texture of pasta with higher water absorption values.

Cooking Loss (CL)

Consumer's acceptance depends on the pasta quality, which is strongly related to low values of cooking loss (CL), consequently to pasta resistance and to disintegration and leaching (Heo et al., 2014; Loubes et al., 2016). The cooking loss values for Adlai pasta varied from 1.00% to 1.85% (Table 4.1), with the lowest CL values in the present study being lower than those of the GF noodles and pasta reported by other authors (Suhendro et al., 2000; Larrosa et al., 2016; Loubes et al., 2016; Wang, et al., 2016). The different Adlai pasta formulations have no significant difference. However, Treatment 4 (control) was significantly different from the Adlai pasta. Moreover, increasing the amount of pregelatinized cassava starch resulted in higher cooking losses. This may be due to the formation of a very sticky

structure of mixed flour as a result of the lack of a well-structured protein reticule, hindering the excessive swelling of the starch granules and the consequent dispersion of components in the cooking water (Marti and Pagani, 2013). However, the CL among GF Adlai pasta samples in the present study was in the range of 1.00% to 1.85% (Table 2) which was in accordance with the research of Doxastakis et al. (2007) who stated that the acceptable level of CL for the spaghetti made from semolina flour should not exceed to 7-8%. Therefore, all pastas in this study have acceptable CL levels.

Sensory Evaluation

Table 3. Results of Sensory Evaluation and ANOVA

Treatment	Appearance	Texture	Aroma	Flavor	Overall Acceptance
1 (100:0)	6.5 ± 1.4^{acd}	6 ± 1.7^{bc}	6.4 ± 1.6^{a}	6.2 ± 1.6^{cd}	6.5 ± 1.5^{cd}
2 (95:5)	6.7 ± 1.3^{ac}	6.4 ± 1.7^{ab}	6.7 ± 1.4^{a}	6.5 ± 1.6^{ac}	6.7 ± 1.3^{ac}
3 (90:10)	6.7 ± 1.8^{a}	6.9 ± 1.5^{a}	6.9 ± 1.5^{a}	6.6 ± 1.6^{a}	6.9 ± 1.6^{a}
4 (Control)	7.5 ± 1.5^{b}	7.4 ± 1.5^{a}	7.02 ± 1.4^{a}	7.2 ± 1.6^{b}	7.5 ± 1.5^{b}

$^{a-d}$Means±SD within the same column followed by the same letter is not significantly different ($p>0.05$)

The selected formulations were used for sensory evaluation and the average scores given by the panelists can be seen in Table 3. The results showed that the degree of liking scores among all pasta formulations were significantly different ($p < 0.05$). Treatment 4 (Control) revealed higher values than the Adlai pasta samples in terms of appearance, texture, flavor, and overall acceptability. Scores in terms of aroma were not significantly different. In addition, the values for texture did not differ ($p > 0.05$) between Treatment 3 (90:10) and Treatment 4 (Control). This indicates that the textural qualities of Treatment 3 (90:10) were comparable to the commercial ones available on the market. Marti & Pagani (2013) stated that consumer acceptance of cooked pasta is based primarily on textural properties. Such an effect might be due to the high protein content of Treatment 3 (90:10) through the addition of egg white protein as well as the addition of xanthan gum and pregelatinized cassava starch. Thus, the developed gluten-free Adlai pasta exhibits a good textural quality, this is due to its protein content of 13.61% which is higher than the control with a value of 8% (Table 4.3). Protein, as stated by Bruneel et al. (2010), is one of the most important factors affecting pasta properties. In addition, the scores of Treatment 2 (95:5) and Treatment 4 (Control) also have no significant difference in terms of aroma. The least favored pasta was Treatment 1 (100:0). This may be due to the lack of hydrocolloids (pregelatinized cassava starch) which can result to a poor binding capacity to water (Padalino et al, 2016) as well as the poor textural properties of the formula that determines a good quality pasta (Marti and Pagani, 2013). Of the Adlai pasta formulations, Treatment 4 (Control) was found to be the most favored, followed by Treatment 3 (90:10), Treatment 2 (95:5) and lastly, Treatment 1 (100:0). Overall, pasta made Adlai flour scored above neutral on acceptability, which implies a good consumer acceptability of the pasta. It is important to note that the pasta was evaluated without sauce which most consumers are not used to. This may explain why the control pasta received a score between slightly liked and moderately liked. The results indicated that the developed GF pasta obtained above neutral scores comparable to the commercial pasta.

Price Comparison of GF Adlai Pasta to Commercially Sold GF Pasta

Table 4. Comparison of Prices between Adlai Pasta (90:10), Brand X, and Brand Y

Products	Commercially Sold GF Pasta (125g)		Adlai Pasta (125g)
	Brand X	Brand Y	Php 25.00
Price	Php 51.00	Php 61.00	

As seen in Table 4, Adlai Pasta is cheaper than the two commercially sold GF pasta. Compared to Brand X and Brand Y, Adlai pasta is half the price of the two selected products. With regards to the packaging expense of the two

commercially sold products, Adlai pasta is still cheaper. The price of Brand X and Brand Y also includes the additives that were present in the production of Adlai pasta

Proximate Composition

Table 5. Proximate Analysis and Total Dietary Fiber of GF Adlai Pasta

Parameters	GF Adlai Pasta	Brown Rice Pasta
Total Calories, kcal/100g	425	365
Total Carbohydrates, g/100g	58.98	75
Ash, g/100g	2.70	n/a
Moisture, g/100g	9.60	n/a
Protein (N x 6.25), g/100g	13.61	8
Total Fat, g/100g	15.11	3
Total Sugars as Invert, g/100g	< 1.80	1

*%Carbohydrates = 100 – (%Moisture + %Ash + %Protein + %Fat)
* "<": less than means the test result is lower than the Minimum Detection Limit

The protein content of the selected GF Adlai pasta formulation was 13.61%, respectively. As seen in Table 5, Adlai flour with addition of egg white protein, xanthan gum and pregelatinized cassava starch resulted in an increased protein content than that of the control (8%). The carbohydrate content of the GF Adlai pasta resulted in 58.98%, respectively. These values are lower than the control (75%).

Ash content is a measure of the nutritive mineral elements in food. The ash content of the GF Adlai pasta reported a high ash content of 2.70%, in line with the study of Jomduang and Bunthawong (2018) which indicates that Black Job's tears grains contained 2.12-2.29% ash and white Job's tears grains contained 0.33-0.69% ash. This could be as a result high mineral content of Adlai flour such as magnesium, calcium, phosphorus, and traces of iron (Chhabra, 2015).

One of the most essential analyses performed on food is moisture assay since water is a major constituent of most food products. Stability and shelf life of food products is greatly affected by moisture (Nielsen, 2010). When foods have less moisture or are dehydrated, microorganisms cannot grow, and foods will not spoil (Gray, 2019). Table 5 shows that the GF Adlai pasta has a high moisture content of 9.60% which closely relates to the study of Chhabra and Gupta (2015) in which the moisture of adlay grains comprises 10.83%. This could be due to the Adlai's high protein content. Proteins found in adlay grains could enhance the molecular interactions between protein and protein, or protein and starch by heat. Hydration of water may be obstructed and could reduce the swelling volume of starch granules (Hamaker et al.,1993). High moisture content considerably affects the shelf life of the product and influences mainly the rheological properties of the final product (Chaisiricharoenkul et al., 2011; Manohar et al., 1999; Maache-Rezzoug et al., 1998).

The fat content of the GF Adlai pasta was relatively higher in comparison to the commercial ones. Nevertheless, this is not a fact of worry for fat accumulation and being overweight as its main source is rice bran oil. Rice bran oil is a good source of unsaturated fats, vitamin E, and other important nutrients. It may also reduce heart disease risk by improving cholesterol levels (Most et al, 2005). When it comes to energy yield, Adlai pasta has a higher calorie content compared to the commercially sold GF pasta.

The levels of fiber content in the GF Adlai pasta were higher compared to the commercial ones. According to Brasil (2012), for a food product to be considered a source of fiber it must have 2.5g of fibers per portion of food. As the GF Adlai pasta had 5.96 g of fiber per portion, it can be considered a source of fiber. Presence of fibers contributes to satiety after food consumption and it can help to lower the glycemic index (Costa et al., 2015; Oliveira, et al., 2016).

Gluten Test Result

Table 6: Gluten Allergen Detection Result

Testing Analysis	Method	Result	Unit
Gluten Allergen	AOAC 2012.01 (21st Ed., 2019) R5 sandwich ELISA method (A)	Not detected LOD = 1	mg/kg

*LOD = Limit of Detection
*The method(s) remarked with (A), (H) and (T) is (are) designated by the Ministry of Agriculture and Rural Development, the Ministry of Health, and the Ministry of Industry and Trade, respectively

The set limit values for gluten-free food were determined (<20 mg/kg gluten) and the R5 sandwich ELISA method was defined for the determination of gluten (Codex Stan, 1979). Gluten test results found in Table 4.4 shows a limit of detection of 1 which indicates that gluten was not detected on the Adlai pasta sample.

CONCLUSION

Based on the overall results, it is concluded that the addition of Adlai flour with PGCS, EWP, and XG to gluten-free pasta significantly affected its cooking properties, sensory attributes, and proximate composition. Sensory evaluation indicated that Treatment 4 (Control) gained the highest acceptability for all sensory attributes (like moderately) and is comparable to Treatment 3 (90:10) in terms of texture. However, scores regarding aroma have no significant difference among the different samples. Since all pasta formulations received scores above neutral, it was determined that GF Adlai pasta has a good acceptability. Regarding the cooking properties, as the levels of PGCS increased, water absorption tended to increase, whereas cooking time and cooking loss were likely decreased. The developed GF Adlai pasta shows a great number of total energy (kcal), protein and dietary fiber that are higher than both the commercial (non-gluten-free) pasta product and GF pasta. However, there was a decrease in the carbohydrate content and the fat content was relatively higher in comparison to the commercial ones. This could be the result of nutritional composition being lost in the milling process or flour storage. Moreover, compared to the commercially available GF pasta, the Adlai pasta is cost-efficient. Thus, results demonstrated that it is possible to develop a good quality gluten-free pasta from Adlai flour. In addition, Adlai flour can be used as an alternative ingredient in order to increase the nutritional value of gluten-free pasta and improve its cooking properties.

For future study, the researcher recommends that texture profile analysis, identifying the pH. and Hunter color values of the Adlai pasta must be done. This is to further understand the effect of the different variables on the textural properties, shelf life, and overall appearance of the product. Controlled working environment must also be observed. It is also recommended to include pasta sauce to mask the color difference among the Adlai pasta samples and the control treatment. Different Adlai varieties must be tested for the feasibility of the utilization of the GF Adlai pasta. Different methods for making Adlai pasta must be done for comparison. The different pasta formulations could also be improved to eliminate other allergens such as egg white powder. Furthermore, it is also suggested that a bigger number of panelists must be included in the sensory evaluation. Lastly, purchase intention, packaging and vitamin analysis must be included in the future study.

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ACADEMIC MOTIVATION AND SELF-REGULATED LEARNING IN PREDICTING ACADEMIC ACHIEVEMENT OF LETRAN FRESHMEN

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ABSTRACT

Quality education is viewed as a crucial factor that weighs in an individual's success in life. The psychological factors behind a student's motives to obtain success in their academics have continued to be an area of interest. However, there has been a lack of an existing study conducted to develop a model of prediction that best explains the most appropriate predictor of academic achievement in a Philippine school setting. Hence, the main purpose of this study is to determine if the academic achievement of first-year college students can be predicted by their academic motivation and self-regulated learning. The study employed correlational predictive design to determine predictive relationships of academic motivation and self-regulated learning for one's academic achievement. The participants are 51 first-year students from Colegio de San Juan de Letran - Manila and were determined using purposive sampling according to an inclusion criteria. The researchers have used an online survey method to gather data from them that consisted of two different research instruments. Statistical findings revealed that there was insufficient evidence to claim that both academic motivation and academic self-regulated learning have significant relationships with the academic achievement of the participants. Conclusively, the study disclosed that both academic motivation and academic self-regulated learning were not significant predictors of academic achievement.

Keywords: academic motivation, academic self-regulated learning, academic achievement

INTRODUCTION

Quality education is widely viewed as a crucial factor that weighs in an individual's success in life. One of the most important milestones one can achieve is the attainment of higher education. In the Philippines, the Commission on Higher Education (CHED) implemented an application for the country adapting on the global teaching-learning methods and competitiveness through CHED Memorandum Order No. 46 in 2012. This aimed to enhance quality assurance of learning and establish an integrated educational system relevant to the needs and demands of the developed countries. The memorandum has been the main impetus of higher education institutions in the country to make certain that Filipino students and graduates will be well-equipped and prepared for the so-called 'real world' (Crespo et al., 2010).

Advancing a globally competitive educational sector is a challenge that the Philippine government needed to address. In the 2017-2022 nationwide Developmental Plan of National Economic and Development Authority (NEDA), it is stated that reducing rates in students dropping out and increasing completion rates across all disciplines in higher education are two of the strategies of CHED in attaining a higher number of human resources in the country. In 2019, Professional Regulation Commission (PRC) and CHED reported that the number of enrollees in higher education institutions for the Academic Year 2018-2019 reached 3.2 million while only 800,000 students are graduating with their

respective degrees. This means that the dropout rate reached an alarming 75.21 percent; majority of them are amongst first-year students. This interminable circulating issue provoked researchers to study the factors that affect the decision of students to drop out. The study of Azarcon et al. (2014) found out that financial constraints and lack of motivation were the usual motivators that greatly determined those decisions of Filipino students.

The motives behind working hard, how to excel in school, being disciplined in class, all in addition to the factors that predict academic achievement of college students have continued to be areas of interest for educational stakeholders, counseling professionals, and researchers in the country. Over the past decades, education has been used as a tool to mold children into a mature, skilled professional ready to take challenges in a competitive global field. However, there is a need to know the predictors of success in academe to lessen the dropout rate in the Philippines, particularly the psychological reasons behind it. Magulod (2017) identified some reasons why students perform poorly in schools that include limited learning resources, financial instability, indiscipline, poor school administration, and such. However, these are considered environmental and economic factors, not psychological. As stated by Alipio (2020), there is a current blur on which of the psychological factors or other cognitive determinants are best considered to be stable and accurate predictors of academic performance in higher education. Hence, this research study focused on two individual factors that may contribute to academic achievement: the academic motivation and academic self-regulated learning of a student.

In discussing both the academic motivation and academic self-regulated learning as variables of this study, both concepts of Self-Determination Theory and Social Cognitive Theory of Self-Regulation, in relation with developmental psychology, are involved. Edward Deci and Richard Ryan (1985) supplied a distinguished approach to motivation and separated it into three categories: amotivation, extrinsic motivation, and intrinsic motivation. The concept for this theory made its reference on an individual's guiding behavior, innate strength, and own psychological needs. The self-determination theory of Deci and Ryan further suggests that people can become self-determined when they have fulfilled their need for autonomy, competence, and connection.

The psychological growth of an individual, as described by the self-determination theory, does not occur instantly. Psychologists assume that growing up, individuals are constantly being influenced by the environmental and behavioral events in their lives. As a result, Robert Bandura (1986) proposed a theory of self-regulated learning of a student established from Social Cognitive Theory. Self-regulation deals specifically with the situation that a learner is in, using their own result-oriented attitude as a reference to deliberately regulate their behavior and establish a learning environment for themselves. In practice, students who are older and have more experience are believed to be able to better self-regulate themselves in a learning set-up, which helps them to further improve their academic performance.

With the Self-Determination Theory and Social Cognitive Theory of Self-Regulation, it is evident that learners differ from each other based on their types and levels of academic motivation, their self-regulated learning strategies, and their performance in academics as a result of the two. This information served as a helpful ground for the researchers to comprehend the psychological factors that may contribute to the academic achievement of learners, particularly students in higher education. The findings of this study may add to the existing literature in predicting the academic achievement of Filipino college students.

Rationale

The study was intended to determine the academic motivation and academic self-regulated learning of students as predictors of their academic achievement in college. The researchers aimed to identify the possible factors and concepts that may contribute to the academic achievement of college students. This led to the consideration of the psychological factors that comprise academic motivation and academic self-regulated learning, which are the variables that the researchers investigated.

A college student whose level of academic motivation is high is believed to have a high success rate in terms of their academic achievement (Ajayi, Lawani, and Salomi, 2012). Motivation encompasses the self-determination of the student to thrive in the field of academics and the urge to achieve success in their efforts and work (Gesinde, 2000). However, the level of motivation differs from one student to another. According to Yarborough and Fedesco (2020), the motivation on how the students act in a learning set-up always concerns the question of 'why'. A student who is highly motivated to do work out of self-interest and curiosity to discovery is said to be motivated intrinsically, whereas another student who is motivated out of getting the approval

of someone else—preferably a person with authority—is said to be extrinsically motivated. Additionally, there is another type of student who lacks personal drive to act or work in a learning set-up, being described as a learner who is amotivated.

These differences in the type and level of academic motivation describes why there are some students who excel and thrive more in school than others despite being subjected to similar experiences of schooling. The significance of the difference in the type and level of academic motivation in predicting academic achievement of first-year students of Letran Manila needs to be explored to help in directing them towards excelling in different learning set-ups.

It is reported by Kitsantas (2002) that there is an interchange between academic motivation and academic self-regulation in predicting academic achievement; and it is important to be investigated more. Self-regulation refers to the thoughts and actions for accomplishing goals that are generated by the self. Dembo and Eaton (2000) found out that a lack of self-regulatory behavior results in underachievement in school performance. Learners with this type of behavior have been discovered to have a sense of control, discipline, and direction towards themselves when dealing with academic tasks. This information in mind stimulated the design of the current study that might contribute to the field of educational research.

There is so far no study conducted to develop a model of prediction that best explains the most appropriate predictor of achievement in a Philippine school setting. Hence, it is unclear which is the best predictor of academic achievement of college students. The purpose of this study is to establish the relationship of academic motivation and self-regulated learning on academic achievement of first-year students of Letran Manila. Additionally, the need to determine if academic achievement can be predicted by both motivation and self-regulated learning is highlighted. The findings of this study may add to the existing materials and literature surrounding predictors of academic achievement of a student.

Conceptual Framework

Figure 1 describes the conceptual framework of the study wherein the interrelationship among the variables is represented. The academic achievement of a student may be influenced by the level of their academic motivation and their self-regulated learning strategy. A student with a high academic motivation score is likely to be a self-regulated learner, thus going to have a high academic performance. On the other hand, a student with a low academic motivation score is also likely to not incorporate self-regulated learning strategies, thus being a low academic achiever.

Figure 1. Conceptual Framework

Review of Related Literature

Academic Motivation

An intensive amount of research has been done in exploring the nature of academic motivation and previous studies have found it relevant in concepts surrounding the behavior of students in their strategies for learning. It is defined that academic motivation, in general, is a drive for executing tasks in school or finishing education. It has been a key factor in engaging in a behavior for learning (Wilkesmann & Virgillito, 2012).

In accordance with the study of Amrai et al. (2011), academic motivation of students is influenced by four factors, namely: external stimuli, internal stimuli, a goal or purpose for the behavior, and an instrument for the behavior. Studies show that academic motivation is indeed susceptible to change as time goes by. It is influenced by external factors as exhibited in Gilig's 2016 study on how higher education curriculum and teaching techniques can either increase or decrease college students' academic motivation through their mainstay in college. The concept that academic motivation is dynamic and can be socially constructed (Jarvela & Jarvenoja, 2011) through the means of a students' environment, is inclined with Bandura's theory on social learning wherein motivation, as the final drive for replicating a behavior, is influenced by what individuals see in their peers or what they consider as role models depending on how these 'role models' are rewarded or punished by society.

The concept that deals with how academic motivation and related variables (e.g., self-efficacy) are related to a student's resulting learning behavior is discussed to be plausible. This is due to previous literature indicating that both extrinsic and intrinsic motivation (e.g., competitiveness, a good future, or earning a reward) serve an imperative role

in determining how they study (Bryant, 2017; Datu 2017). According to Mizuno et al. (2011) in their study of academic motivation, their results show that cognitive function has no significant relationship with any decrease of motivation in students, although it does associate itself with memory. Furthermore, academic motivation actually deals better with significant relationship on factors like academic achievement and an individuals' self-concept of whether they are more likely to be successful in a task (Bryant, 2017; Steinmayr, 2019).

In relation, numerous previous studies have also shown a positive significant relationship between academic motivation and academic achievement through correlational approaches and determining how different domains of student motivation influence or contribute to their resulting academic achievement (Steinmayr, 2019; Amrai et al., 2011).

Academic Self-regulated Learning

Self-regulation is defined as the beliefs of the learners about their capability to engage in appropriate actions, thoughts, feelings, and behaviors in order to pursue valuable academic goals (Zimmerman, 2001). There have been many studies conducted regarding the relationship of self-regulated learning, and how it affects academic performance in the classroom, whether it be on physical ground (face-to-face classes) or through the internet (online classes). With self-regulated study, there are also other factors involved and carefully studied (i.e., academic motivation, environment, and self-control). There are factors that may very well affect the students' performance and capability that are not always seen because it all happens behind the scenes; mostly, behind the eyes of educators.

Inside school premises, teachers have a vital role in promoting self-regulated learning. Before they even promote it to students, they themselves have to be practicing self-regulated learning so that when they present it to their class, it is presented in a way that is interesting to the students (Moos & Ringdal, 2012). In order to achieve this, teachers are given different techniques to promote self-regulated processes that facilitate their learning. Those techniques are as follows: goal setting (Winne & Hadwin, 1998; Wolters, 1998), planning (Zimmerman, 2004), self-motivation (Corno, 1993; Wolters, 2003; Zimmerman, 2004), attention control (Harnishferger, 1995; Kuhl, 1985; Winne, 1995), flexible use of learning strategies (van den Broek et al., 2001; Winne, 1995), self-monitoring (Butler & Winne, 1995; Carver & Scheier, 1990), appropriate help-seeking (Butler, 1998; Ryan, Pintrich, & Midgley, 2001), and self-evaluation (Schraw & Moshman, 1995).

Regarding self-regulation learning through online classes, the study conducted by Yot – Dominguez, and Marcelo (2017) shows that students do not even utilize self-regulated learning techniques due to the fact that technology is readily available everywhere. With a simple search on the internet where they easily have their answers to their inquiries, it harms the students as they do not go through the processes that Zimmerman proposed that helps the student get better at their work.

Relationship between Academic Motivation & Self-regulated Learning

In the study of Jarvela & Jarvenoja (2011) on both variables, their findings came upon the conclusion that motivation can be considered a socially constructed concept and that regulating academic motivation holds a great deal of necessity for the students' capability of a socially self-regulated learning. Moreover, the discussion of statements about how self-regulated learning is driven by one's academic motivation can be influenced by the environmental state of a student where they learn. The claim is made evident by Boekarts & Cascallars (2006) where they mention in their study that the ability to study effectively through self-regulated learning is a behavior that is driven by a will or a motivation to do so. Successively, self-regulated learning is induced by an individual's self-concept of how they should learn, which then is influenced by factors concerning their social interactions, hence the variables being 'socially constructed' because learning behaviors are affiliated with motivation, which is the affiliated with how students observe the subject or role models in their surrounding; a concept inclined with Bandura's Social Learning Theory.

Mahmoodi, Kalantari & Rozhin (2014) explored the self-regulatory learning strategies used by their respondents who are 130 students taking English as a Foreign Language (EFL). They also established the relationship between motivation and self-regulated learning and the relationship between self-regulated learning and achievement. Findings of their study concluded that there is indeed a positive significant relationship between the variables of academic motivation and self-regulated learning of students. However, the relationship between self-regulated learning and achievement was considerably weak. The established relationship between

academic motivation and self-regulated learning supports the statements of how the academic motivation of students measured through a scale can predict their possible academic achievement.

In addition to this, a study done by Harris et al. (2002) stated that factors (i.e., motivation, self-control, and self-regulation) is indeed a driving force where it can dictate how a student does an activity or does any sort of challenges for that matter. Moreover, Graham & Harris (2005) also emphasized the fact that teachers have such a vital role in making sure that students develop good study habits by carefully demonstrating specific self-regulation tactics that will greatly improve students' learning moving forward.

Statement of the Problem

Poor academic success among Filipino college learners may lead to the downfall of CHED's strategies in reducing rates of dropouts and increasing completion rates across all disciplines in higher education in the country. Thus, there is a need to explore and investigate the psychological factors that are linked with the academic achievement of a learner. Establishing the predictive weight of the academic motivation and academic self-regulated learning is also beneficial for the study's aim to determine if they can predict the academic achievement of first-year students in Letran Manila.

The current study sought to determine the answers to the following questions:

- Is there a significant relationship between the academic achievement of first-year students in Letran Manila and their academic motivation?

- Is there a significant relationship between the academic achievement of first-year students in Letran Manila and their academic self-regulated learning?

- Can the academic achievement of first-year students in Letran Manila be predicted through their level of academic motivation and academic self-regulated learning?

Hypotheses

This study was guided by the following null and research hypotheses:

H_{01}: There is no significant relationship between academic motivation and the academic achievement of first-year students in Letran Manila.

H_{a1}: There is a significant relationship between academic motivation and the academic achievement of first-year students in Letran Manila.

H_{02}: There is no significant relationship between academic self-regulated learning and the academic achievement of first-year students in Letran Manila.

H_{a2}: There is a significant relationship between academic self-regulated learning and the academic achievement of first-year students in Letran Manila.

H_{03}: Academic motivation and academic self-regulated learning do not significantly predict academic achievement of first-year students in Letran Manila.

H_{a3}: Academic motivation and academic self-regulated learning significantly predict academic achievement of first-year students in Letran Manila.

METHODOLOGY

This research employed a descriptive correlational design in determining and examining the association between the variables. A descriptive correlational design is a type of non-experimental research design that measures a relationship between two given variables without the intervention of the researcher. Its purpose is to determine whether there is a positive (where both variables change in the same direction), a negative (where the variables change in opposite directions), or a zero correlation (no relationship is found). Additionally, the predictive nature of the said design was used to determine predictive relationships of academic motivation and self-regulated learning (as predictors) for the academic achievement (as criterion variable) of first-year students of Letran Manila.

Participants

The participants of this study were 51 first-year students of Colegio de San Juan de Letran – Manila that are currently enrolled for the Academic Year 2020-2021 from ten different undergraduate programs: 23 participants from BS Psychology, nine from BS Civil Engineering, five from AB

Communication, three from BS Accountancy and BS Information Technology, two from AB Political Science, BS Business Administration, and BS Nutrition and Dietetics, and one from BS Electronics Engineering and BS Electrical Engineering.

Participation was voluntary, and the technique of determining the participants used purposive sampling according to an inclusion criteria set by the researchers: (1) must be a bonafide First-Year student in Letran Manila, and (2) must be willing to share their GWA on the first semester of A.Y. 2020-2021, They were informed firsthand by the researchers about the nature of the study through an informed consent form provided in Appendix A.

Instruments

The researchers used a survey questionnaire method to gather data from the participants. The survey consisted of demographic information questions and two different research instruments. The demographic component included questions regarding age, gender, college program, and their GWA in the first semester of the A.Y. 2020-2021. The instruments utilized were the Academic Motivation Scale (AMS) and Academic Self-Regulated Learning Scale (A-SRL-S)

Academic Motivation Scale (AMS)

The Academic Motivation Scale (AMS) is constructed and developed by Vallerand et al. (1992) that is used to measure the academic motivation of the respondents. The scale includes 28 items divided into seven subscales: three factors for intrinsic motivation (to know, toward accomplishment, to experience stimulation), three factors for extrinsic motivation (identified, introjected, and external regulation), and one factor for amotivation. Each factor has four items, and each item has seven-point response categories ranging from 1 = totally disagree to 7 = totally agree. Validity and reliability evidence is collected from studies conducted by Vallerand et al. (1992) with 745 college students from the province of Ontario, Canada. The reliability evidence is obtained through internal consistency using Cronbach's alpha reliability. The validity evidence is obtained through peer review, confirmatory factor analysis, examination of relationships, and relations with other variables. Vallerand et al. (1992) reported that reliability coefficients and the test-retest correlations of the subfactors are considered to be high enough to warrant the use of the scale as shown in Table 1.

Table 1. Internal Consistency Values and Test-Retest Correlations of Academic Motivation Subscales

Subscale	Number of items	Cronbach's alpha reliability coefficient	Test-Retest correlations
IM – to know	4	.84	.79
IM – toward accomplishment	4	.85	.83
IM – to experience stimulation	4	.86	.80
EM – identified regulation	4	.62	.71
EM – introjected regulation	4	.84	.73
EM – external regulation	4	.83	.83
Amotivation	4	.85	.83

Note. IM - Intrinsic Motivation. EM - Extrinsic Motivation.

Academic Self-Regulated Learning Scale (A-SRL-S)

The Academic Self-Regulated Learning Scale (A-SRL-S) is constructed and developed by Magno (2010) that is used to measure the academic self-regulated learning of the respondents. The scale includes 55 items divided into seven subscales under self-regulation: (1) memory strategy, (2) goal setting, (3) self-evaluation, (4) seeking assistance, (5) environmental structuring, (6) learning responsibility, (7) planning and organizing. Each item has four-point response categories ranging from 1 = strongly disagree to 4 = strongly agree. Validity and reliability evidence is assessed by Magno (2010) with the Filipino college students who answered all of the items in the A-SRL-S. Internal consistency, person, and item reliability were obtained and thus revealed very high consistencies from its responses as shown in Table 2. Furthermore, the convergent validity evidence is obtained and established through significant intercorrelations of the factor scores administered to a sample of 2052 Filipino college students (Magno, 2010).

Table 1. Internal Consistency and Reliability Values of Academic Self-Regulated Learning Subscales

Subscale	Number of Items	Cronbach's alpha reliability coefficient	Person reliability	Item reliability
Memory Strategy	14	.82	.80	.99
Goal Setting	5	.76	.76	.89
Self-Evaluation	12	.81	.81	.98
Seeking Assistance	8	.66	.66	.98
Environmental Structuring	5	.65	.65	.97
Learning Responsibility	5	.67	.67	.97
Planning and Organizing	6	.61	.61	.83

Data Collection and Procedure

This study aimed to determine the significant relationship between the academic achievement of the first-year students of Colegio de San Juan de Letran - Manila and their motivation and self-regulated learning. It also aimed to determine whether the two variables significantly predict the students' academic achievement as indicated by their GWA. The process in gathering the data in this study was described in the following steps: (1) the researchers created an online survey questionnaire approved by their Psychological Statistics professor, (2) the researchers sought permission from the participants regarding the study, (3) the researchers sought consent and explained the implications of their participation before answering the questionnaires through an informed consent form, and (4) the survey form was made in Google Forms and was distributed through the Facebook group of the first-year students.

Ethical Considerations

Before proceeding to the actual process of data gathering, the researchers made sure that the instruments were approved by both of their professors in Psychological Statistics and Developmental Psychology. Afterwards, the online survey questionnaire made on Google Forms was approved and the purpose of the research was stated through the informed consent of the survey form before asking for the students' consent to participate. Inclusion criteria was also mentioned and given emphasis since the study involves the participants' GWA in the first semester of the A.Y. 2020-2021—a personal and confidential school information that a student must willingly share through self-report. Additionally, the responses and identities of the participants were assured of confidentiality and anonymity throughout the entire conduct of the data collection.

Statistical Analysis

All of the quantitative data obtained from the survey questionnaire was coded for statistical analysis using JASP 0.14.1. Data cleaning and management were done to ensure that there are no outliers or inappropriate entries which may tarnish the results of the study. In the method of data analysis, descriptive statistics (i.e., frequencies, mean, standard deviation) were employed to describe, summarize, and present information (i.e., age, gender, program, GWA) of the participants together with their academic motivation and academic self-regulated learning scores. Moreover, inferential statistics were employed to test each of the following null hypotheses of the study:

H_{01}: There is no significant relationship between academic motivation and the academic achievement of first-year students in Letran Manila. (Pearson correlation analysis was used as the statistical test)

H_{02}: There is no significant relationship between academic self-regulated learning and the academic achievement of first-year students in Letran Manila. (Pearson correlation analysis was used as the statistical test)

H_{03}: Academic motivation and academic self-regulated learning do not significantly predict academic achievement of first-year students in Letran Manila. (Multiple regression analysis was used as the statistical test)

RESULTS

The results of this study were presented in accordance with its objectives by presenting the descriptive and inferential statistics for each objective given.

Results of the descriptive statistics were presented in Table 3 where the participants' academic motivation scores, academic self-regulated learning scores, and academic achievement through their general weighted average (GWA) in the first semester of the Academic Year 2020-2021 on Colegio de San Juan de Letran – Manila were analyzed. Table 3 reports the difference in the means of the academic motivation scores (M = 6.19, SD = 3.42), academic self-regulated learning scores (M = 166.16, SD = 17.34), and the GWA (M = 91.76, SD = 2.17) of the 51 participants.

Table 3. Means and Standard Deviations of Academic Motivation, Academic Self-Regulated Learning, and Academic Achievement through GWA

	n	Mean	Standard Deviation
Academic Motivation	51	6.19	3.42
Academic Self-Regulated Learning	51	166.16	17.34
Academic Achievement (GWA)	51	91.76	2.17

In determining the relationship of the participants' academic motivation and academic self-regulated learning to their academic achievement, these null hypotheses were tested and put through a Pearson correlation analysis:

H01: There is no significant relationship between academic motivation and the academic achievement of first-year students in Letran Manila.

H02: There is no significant relationship between academic self-regulated learning and the academic achievement of first-year students in Letran Manila.

Table 4 shows the correlations between the academic motivation, academic self-regulated learning, and GWA of first-year students in Letran Manila. There was a weak positive relationship between academic motivation and academic achievement (r = .112, p = n.s.). Likewise, there was a weak positive relationship between academic self-regulated learning and academic achievement (r = .169, p = n.s.). By the strength of these correlations, it can be inferred that this statistical evidence was sufficient to claim that both academic motivation and academic self-regulated learning do not have a significant relationship with the academic achievement of the participants.

Table 4. Correlations between Academic Motivation, Academic Self-Regulated Learning, and Academic Achievement through GWA

Variable	1	2	3
1. Academic Motivation	—		
2. Academic Self-Regulated Learning	.152	—	
3. Academic Achievement (GWA)	.112	.169	—

This research was conducted to determine if academic motivation and academic self-regulated learning significantly predict the academic achievement of first-year students in Letran Manila. It is hypothesized that the two predictor variables are positively associated with academic achievement, which is represented by the GWA. To test this hypothesis, multiple regression analysis is used.

Table 5. Analysis of Variance (ANOVA) for the Prediction of Academic Motivation and Self-Regulated Learning in Academic Achievement

Source of Variation	*SS*	*df*	*MS*	*F*	*p*
Between Groups	8.53	2	4.27	0.901*	0.41
Within Groups	227.28	48	4.74		
Total	235.81	50			

*F_{crit} = 3.19. Therefore, accept *Ho*.

Table 6. *Multiple Regression Analysis with Academic Achievement (GWA) as the Outcome Variable*

	GWA of First-Year Students in Letran Manila			
Variable	***B***	***SE***	***t***	***p***
Academic motivation	0.056	0.091	0.615	0.542
Academic self-regulated learning	0.020	0.018	1.086	0.283

Note. R = .190, R^2 = .036, Adjusted R^2 = -.004

Statistical results presented in Tables 5 and 6 show insufficient evidence to support academic motivation and academic self-regulated learning as significant predictors of academic achievement, F(2,48) = 0.901, p = n.s., as there is a weak positive relationship between the variables, collectively, r(48) = .19, p = n.s.. Thus, both academic motivation (B = 0.071, p = n.s.) and academic self-regulated learning (B = 0.021, p = n.s.) did not significantly predict the academic achievement of the participants. Nevertheless, total academic motivation and self-regulated learning scores together only explain 3.6% of the variance in GWA that can be accounted for by the two given variables, with adjusted R2 = -0.4%. The overall results of the study suggest that both academic

motivation and academic self-regulated learning are not significant predictors of academic achievement.

DISCUSSION

The primary objective of this study was to determine whether there is a significant relationship between the academic achievement of the first-year students and their academic motivation and academic self-regulated learning. It also sought to investigate whether the two variables significantly predict students' academic achievement as indicated by their GWA. The researchers found that the relationship between the two variables bear no significant relationship due to its positive yet weak correlation which cannot be statistically considered. In light of the latter, the resulting correlation between academic self-regulated learning and the academic achievement of students also shows the same weak positive relationship leading the researchers to accept both the null hypotheses for the correlational aspects of the study. In the usage of multiple regression analysis to determine whether the predictor variables can significantly predict the students' academic achievement, the results show that it cannot significantly do so in accordance with the produced values from the hypothesis testing. The researchers were led to accept the null hypothesis for the multiple regression analysis, therefore stating that academic motivation and academic self-regulated learning do not significantly predict academic achievement of first-year students in Letran Manila.

The current findings of the study are in line with an early study done by Eom, Ashill, & Wen (2006) when discussing the significant relationship between academic motivation and perceived learning outcomes. It was indicated in their study that factors such as intrinsic motivation and extrinsic motivation played no role in the student's learning outcomes when doing their schoolwork. In an updated finding, Eom (2011) stated that by applying Zimmerman's view of self-regulated learning to their study now affirms that motivation has a direct, positive, and significant effect on the students' academic performance and achievement. For this study, Eom used the Partial Least Squares (PLS) Model in order to see the relationship between intrinsic motivation and extrinsic motivation in the student's academic performance. With this model being used for their study, Eom stated that between the two variables, the intrinsic motivation played a significant role in self-regulated learning compared to the extrinsic motivation, wherein it shows that it had no significant relationship with the learning outcomes.

Contradictory findings are shared by numerous studies and previous literature due to the common nature of the variables to correlate with one another. A study by Amrai et al. (2011) contradicts the findings of the present study as it explores similar variables wherein the past study determined the relationship between academic motivation and the academic achievement of students in the Tehran University. However, the study reported a statistically significant relationship between the two variables that led Amrai (2011) to reject their null hypothesis. The quantitative design of the study used a correlational approach in testing their hypothesis, took the participation of 352 students, and used Pearson's r correlation coefficient as their test of statistics. From the population cited in the study of Amrai et al. (2011), the contradiction on the number of respondents is evident, which poses a contributing factor to the conflicting results of the two studies.

In contrast to the present study, a research by Mahmoodi, Kalantari & Rozhin (2014) explored the self-regulatory learning strategies used by their respondents who are 130 EFL students in Iran. They also established the relationship between motivation and self-regulated learning, and the relationship between self-regulated learning and academic achievement. Findings of their study concluded that there is indeed a positive significant relationship between the variables of academic motivation and the self-regulated learning of students, while the relationship between the latter and achievement was considerably weak yet still worth noting to be statistically significant. It can be drawn from the findings of Mahmoodi, Kalantari & Rozhin's (2014) that the given variables they used in their research (academic motivation, academic self-regulated learning, and academic achievement) posed a connection from one another in the context of their respondents in Iran, which do not align with the locale of the current study. Although motivation and self-regulated learning can be widely seen as a hand-in-hand mechanism to improve achievement, no significant relationship was found at least in the contexts of the present study. This could be explained by the extent of different learning strategies favored by the participants to incorporate in their education, and the processes that mediate between their personal and environmental characteristics.

This study had several notable limitations which affected the findings of the research. As mentioned, a major factor for all the related literature was its sample size. For the current

study, only 51 first-year students of Letran Manila signed up to participate in the study, which is relatively small in comparison to the mentioned contradicting studies that resulted in statistically significant results. This limitation is acknowledged with its connection with the time constraint of the schedule of the researchers, challenging online learning set-up, as well as the inclusion criteria that required them to share their GWA, in which they may feel opposed to giving that information. Another limitation was that only first-year students could participate in the survey, indicating that the findings may not be representative of the whole population of the students in Letran Manila and thus suffered from limited generalizability.

CONCLUSION

Quality education is a crucial factor which heavily contributes to the success of an individual over the course of their lives. The difference between students in academic success can be observed evidently through their academic performance as a result of academic motivation and self-regulated learning strategies. In the present study of academic motivation, academic self-regulated learning, and academic achievement of college students, the researchers aimed to determine the predictive weight of the two independent variables on the academic achievement of first-year college students. Determining the significant relationships and a probable regression equation between the variables open avenues for this study to contribute to societal research in matters of Psychology and other disciplines which may further improve existing data and research with the same rationales. Specifically, this study can be of considerable contribution to the field of Developmental Psychology, with the variables having an involvement on Self-Determination Theory by Deci and Ryan (1985), and Social Cognitive Theory of Self-Regulation by Bandura (1986) that guide researchers to study about the psychological factors that may contribute to the academic achievement of learners, particularly in higher education.

The results of the study presented evidence with reference to the hypothesized relationship among the research variables. The two predictors were found to have a nonsignificant relationship with students' academic achievement. These variables were analyzed as a whole and have not taken into consideration the individual domains within academic motivation and strategies within self-regulated learning that could possibly explain their influence on academic achievement. Nonetheless, several external factors may contribute to the overall findings of the study that include challenging online classroom set-up and distance learning. Mutua (2014) highlighted the importance of collaborative learning, peer learning, and seeking constructive help in their similar study, in which both academic motivation and academic self-regulated learning significantly predict the academic achievement of Kenyan public secondary students. As such, the students' desire and satisfaction in learning may be affected by the current disruption of education and worldwide closing of schools in this academic year. It can be highlighted from Mutua that results greatly vary depending on the environment the student is in, wherein their study is on a traditional learning set-up and this study is under the 'new normal', presenting an evident difference on the setting of both studies.

In addition, the polarization of the students' GWA and scores from the research instruments has been evaluated as a factor for the lack of significant prediction of academic achievement by the predictor variables. Cetin (2015) highlighted this similarity in their study, in which they also determined possible psychological factors (i.e., intelligence, reasoning skills, academic attitude) that might affect the prediction of academic achievement of college students. Since motivation has an established direct effect on achievement, it is necessary to delve into extrinsic factors that might support intrinsic motivation, as stated by Eom (2015) in their study that highlighted these divisions and produced positive significant effect on achievement.

The key findings present answers to the laid-out research questions of the study: (1) there was an insufficient evidence for establishing a significant relationship between academic motivation and academic achievement, (2) there was an insufficient evidence for establishing a significant relationship between academic self-regulated learning and academic achievement, and (3) the academic achievement of a student cannot be significantly predicted through their level of academic motivation and academic self-regulated learning. Since the researchers accept the null hypotheses, the final conclusion of the correlational predictive study is that there is no significant relationship between academic motivation, academic self-regulated learning, and the academic achievement of first-year students in Letran Manila.

RECOMMENDATION

One of the notable limitations of this study is its limited sample size, with only 51 first-year students signed up as participants. Therefore, as a recommendation, future researchers that plan to further improve the study should seek a larger number of respondents. With a wider range of participants, it could reduce the probability of having biased groups. It can also provide more accurate statistical values by identifying the outliers to provide a smaller margin of error to the research.

Since the setting takes place in the Philippines and the A-SRL-S utilized for this study is developed by a Filipino researcher, a development and utilization of a local scale for academic motivation must also be considered. This should take into consideration the extrinsic factors such as the learning set-up, mode of education, social and cultural context, and other components that can affect the ability of the student to learn to a great extent. In addition, it is recommended for future studies that all strategy-use components of students are considered such as the cognitive and metacognitive strategies. Future researchers must explore and investigate all domains of motivational constructs such as intrinsic and extrinsic motivation, self-efficacy, and grade motivation to produce a deeper understanding and substantial findings with reference to the study.

The study focused on only one avenue as an indicator of academic achievement, which is the GWA of the students. Future researchers can explore standardized test results as a significant criterion instead of GWA as it may provide different results from the participants. All things considered, the opportunity remains wide open for the future researchers to develop an accurate model of prediction that best explains the most appropriate predictor of academic achievement in a Philippine school setting.

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PHOTOLUMINESCENT STRUCTURES: A TRUE EXPERIMENTAL STUDY INTO LUMINOUS FLUX EFFICIENCY AND VIABILITY

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ABSTRACT

Photoluminescence structure is a concept that has existed for decades. The idea that a single structure could emit natural light without the need for electricity, dangerous emittance of temperature or radiation has enticed engineers. The phosphor ZnS:Ag or Silver- Activated Zinc Sulfide is known for its brilliant blue hue during photoexcitation. This generates a bright and sustained emission of light without the need of electricity. As the reaction is not caused by direct heat or a reaction due to ignition or explosion, it is not considered phosphorescent in nature. But rather photoluminescent. This is mainly because the process, photoexcitation, causes light photons to be absorbed by the molecular structure of the atoms. Known to be stable and highly efficient as a semiconductor, the light emitted by the reaction is bright blue as silver is its activator. In order to determine the efficiency, luminous flux (lx), a derived unit of measurement from lumens (lm), in which it too is derived from the base SI Unit- Candela (cd) is used. One lx is equivalent to one lm per square meter. Over time, the efficiency can be determined. Additionally testing for Viability (V) is determined by three sub-variables, namely V1-lm or Light observed on objects, V2-t, or luminescence endurance, and V3E-lm or Environmental luminescence. Combined they are used to determine the viability of the phosphor in physical applications as a replacement to traditional light sources such as CFL, LED, or Incandescent. The light is measured through photometry and not photo-spectroscopy. This involves the use of a photometer rather than a spectrometer. This is done because the test sample is not quartz-cubed and would require a laser-based spectrometer. To simplify and receive similar results with respect to the instrument, a photometer is used instead. The collected data is originally determined in Lux but is converted into the needed data. After following a stringent testing protocol, the data is tabulated, analyzed, and graphed. The data was found to show a trend in decreasing luminosity count in relation with time. As time increased, luminosity decreased. This is expected as the phosphor gradually loses its photons to emit, and thus light is slowly reduced to undetectable units. Additionally, the length of time it took for the luminosity of the phosphor to become undetectable was surprisingly high. Averaging seven to eight hours at maximum peak brightness of 3.9 lux.

Keywords: Photoluminescence, Photometry, Luminosity, Luminous Flux (lx), Lumens (lm), and Silver-Activated Zinc-Sulfide (ZnS:Ag)

INTRODUCTION

In 2014, the city government of Manila implemented a P2.2 billion project to discharge 10,000 solar-powered streetlamps to decrease the energy consumption of the local government (Sauler, E., 2014). Solar streetlights are appraised as result of a Study on the Efficiency of Solar lights in Intramuros (Claridad et al., 2017) wherein it was delineated as the easiest way to conduct light with its dependence on a

natural source of power which is solar energy, through photovoltaic panels, and its low maintenance of keeping the material workable and feasible. However, with the reason for its immoderate prices and costs, it will be resistant to be established nationwide due to a foundationless local government in regard to energy supply. According to the Journal of Energy and Power Engineering (Billanes et al., 2017), the Philippines is included as one of the countries with the highest paying rate of electricity as a result of importing fuel from other countries and not owning a stable energy supplier nationwide. As already stated, the Philippine Government does not supply the costs of electricity. The Department of Energy (DOE) responded that supporting the electric status of the Philippines will only lead to vague and bureaucratic actions and decisions (Rood, 2015).

In those factors, the city government of Manila executed a project to elevate the standard of the city and conceivably solve the issues. However, as per the International Energy Agency (2002), solar-powered streetlights can be hazardous to nearby environments for it can be easily activated by other toxic compounds even if indirectly. Compounds such as cadmium telluride that is a part of the solar panel, when inhaled causes lung inflammation, and lung fibrosis (Nguyen, 2017). Even if it is powered by a natural source of energy - sunlight there are still cons that cause uncertainty to execute the project nationwide. Since 1990, the energy crisis is one of the major problems of the Philippines that cannot be solved that easily if there would be no alternative to modern light sources that brightens up the surroundings yet prolongs the high electricity consumption of the country.

The perpetuating energy crisis would only be an additional factor in pulling the government down. It has been three decades of letting the crisis enter the country yet there is no concrete solution to reduce it. Thus, in relation, there are still other light sources that Filipinos can benefit from. Photoluminescence also emits light in any form of matter ensued from the absorption of Photons. Thus, relating it to artificial light sources existing in Manila, it can also be utilized in discharging light in structure based. It will be investigated and experimented with the support of a Photolumic Phosphor - Zinc Sulfide activated with Silver (ZnS:Ag) to test the luminous flux and viability of a structure coated with Photoluminescent. By knowing that there are existing modern and fixed streetlights in Manila, finding an alternative source of light that is neither attached nor electrical would be very beneficial to the city in different aspects and could be applicable nationwide. A Photoluminescent structure could be an effective substitute to traditional street lights or any other artificial light source, thus the question, What is the impact of the Photoluminescent Coating (ZnS:Ag) on luminous flux (lx) efficiency, light spread in lumens (lm), and viability (V)?

Literature Review

According to Gfroerer (2000), Photoluminescence (PL) is the spontaneous emission of light from a material under optical excitation. Additionally, Photoluminescence (PL) is observed to last longer than Phospholuminecence under excitation that is caused by ultraviolet-ray exposure rather than chemical reaction which is shorter and generally brighter (Caper et.al. 2017). As for the selected photolumic phosphor, "Zinc sulfide (ZnS) activated with Ag (Silver) ions is known for its brilliant blue luminescence under excitation with high energy photons, electrons or ions." (Mikhailik et. al., 2012). However, "Fluorescence and phosphorescence are particular cases of luminescence. The mode of excitation is absorption of one or more photons, which brings the absorbing species into an electronic excited state. The spontaneous emission of photons accompanying de-excitation is then called photoluminescence which is one of the possible physical effects resulting from interaction of light with matter." (Valeur, 2013). Additionally, according to Valeur and Santos (2011; Valeur, 2017), "In contrast to phosphorescence, the etymology of the term fluorescence is not at all obvious. It is indeed strange, at first sight, that this term contains fluor which is not remarked by its fluorescence!" The definitions of fluorescence and phosphorescence, as given in the Glossary of Terms used in Photochemistry published by the International Union of Pure and Applied Chemistry (1926; Valeur, 2017), are as follows: Fluorescence: spontaneous emission of radiation (luminescence) from an excited molecular entity with retention of spin multiplicity. Phosphorescence: phenomenological, is a term used to describe long - lived luminescence. In mechanistic photochemistry, the term designates luminescence involving change in spin multiplicity, typically from triplet to singlet or vice versa. Alternatives according to Depika, Kaaviya, Kavitha, & Indhumathi (2019), a pigment that has the ability to produce light in a dark environment is said to be photo luminescent. Strontium Aluminate doped with rare alkaline earth elements from the lanthanide series, primarily Europium and Dysprosium, is proven to absorb radiant light energy and slowly release it as glow in the absence of the light source. Hence Strontium Aluminate doped with Europium and Dysprosium activators was adopted to achieve brighter

afterglow in the concrete. Thus, Luminescence flux (lx) efficiency of ZnS:Ag is required to be investigated. According to Derlofske & Taylor (2000), Luminescence Flux (lx) is a SI-derived unit of another SI-derived unit- Lumens (lm) that originates from Candela (cd). As One lx is equal to one lm/m2 (Area). Thus, luminous flux efficiency of ZnS:Ag, a Photoluminescent phosphor has not been investigated to date, thus the conduction of this true experimental study by the researchers.

As per Caper et.al. (2017), Lumens (lm) is a photometric (light) SI-Derived unit for Candela (cd) used in measuring the total quantity of visible light emitted by a source per unit of time. The basic setup for measuring luminous intensity involves a light detector located a certain distance in front of a point source. Its numerical response, 'n', depends on the impingement rate (flux) and wavelength of photons. The detector's spectral sensitivity matches that of the human eye. This enables the detector's response to be calibrated to indicate lumens (luminous flux). (Nilson, 2009). Avoidable light pollution refers to light flow emitted at night by artificial light sources which are inappropriate in intensity, direction and/or spectral range, unnecessary to carry out the function they are intended for, or when artificial lighting is used in particular sites, such as observatories, natural areas or sensitive landscapes. Among all causes having a negative effect on night sky quality, light pollution shows the highest immediate risks but, at the same time, it can be reduced through viable solutions. (Rajkhowa, 2012). According to Gaston, Bennie & Hopkins (2014), artificial lighting has transformed the outdoor nighttime environment over large areas, modifying natural cycles of light in terms of timing, wavelength, and distribution. This has had widespread benefits and costs to humankind, impacting on health and wellbeing, vehicle accidents, crime, energy consumption and carbon emissions, aesthetics, and wildlife and ecosystems. Light scatter (in Lumens) has been often avoided as a parameter for viability. However, if scaled, could lead to increased parametric viability, thus the added investigation into the matter.

According to Dipika et.al. (2019), Viability (V) is determined by a subset of pre-attached variables that justify viability for implementation in a particular field of interest i.e. construction, medicine, engineering, etc. From these considerations re-emerge the ideas of Peccei (2013) and King (2013) that recognize in the systemic thought the foundations for a sustainable society. The present study derives from these considerations and aims at contributing to the advancement of the knowledge necessary to overcome the challenges in the sustainability field." (Formisano, Quattrociocchi, Fedele, 2018). The principal analytical tool of viability theory is the viability kernel which describes the set of all state-space points in a constrained system starting from which it is possible to remain within the system's constraints indefinitely. (Krawczyk & Pharo, 2013). Financially, a clear economic rationale for public sector involvement helps to narrow the range of alternative ways of addressing a development problem. Public intervention is justified when a market fails to deliver goods and services efficiently. Market failures can arise from various factors such as increasing returns to scale, externalities, asymmetric information, unspecified property rights, coordination failures, and specific characteristics of certain public goods that make their use nonrival and nonexcludable. (Asian Development Bank, 2017). Additionally, as added note on its sub-variables, Ecological light pollution comprises direct glare, chronically increased illumination and temporary, unexpected fluctuations in lighting. The sources of ecological light pollution are very various and found in nearly every ecosystem in the form of sky glow, illuminated buildings and towers, streetlights, fishing boats, security lights, lights on vehicles, flares on offshore oil platforms, and even lights on undersea research vessels. (Rajkhowa, 2012). It is important to note that parametric viability (V) on ZnS:Ag for probable implementation on public-use structures has not been explored to date, and is in relation to luminous flux efficiency and light scatter, thus the need for investigation.

The researchers draw importance on the Theory of Luminescence by Stepanov & Gribkovskii (1968) and from Valeur's Molecular Fluorescence Principles and Applications (2013) to determine the impact of ZnS:Ag, a Photoluminescent Coating, on luminous flux (lx) efficiency, light spread (scatter) in lumens (lm), and viability (V) for real world implementation on man-made structures. According to Taylor (2000), the theory of luminescence was created when a faint glow emanating from a rotting tree bark was discovered and observed in the early 1800s. Since then, the theory has expounded on luminosity valence and various conjectures have been formed on their origin, synthesis, and possible real-world application." As for Valeur (2017), the theory was the beginning of scientific and grounded exploration into biochemical photosynthesis that created illumination from absorption of photomater (visible light) which ultimately led to the advancements in research of phosphors and their various outputs. In relation to this investigation, Photoluminescence has been the topic of modern construction sciences for decades. Yet much is still

unknown about their viability. Additionally, combination of various aggregates into a phosphoric chemical mixture can hamper the overall effectivity of such a product. The researchers do note however that this could have been more applicable as an additional layer in construction rather than integration into a singular product.

To justify, Valeur's Molecular Fluorescence Principles and Applications (2013) adds additional importance and justification on the basis of Stepanov & Gribkovskii's work. As per Spunei & Chioncel (2017), the adaptation of the theory of luminescence and phosphors paved the way to electroluminescence that is essential to the creation of more powerful semiconductors used in most electronics today. Additionally, the theory laid the foundations for powerful superconductors that operate at specific conditions that can hold immense amounts of power for long periods of time without risk of forming Dendrites and other traditional alternatives like Li-po (Lithium-Polymer) or NiMH (Nickel-Metal Hydride) batteries. To that effect, the study into luminosity flux efficiency and viability of the phosphor ZnS:Ag is warranted as there have been no previous attempts to do so, thus the conduction of this investigation.

Hypotheses

A. A higher luminous flux count (lx) generates a brighter glow per square meter.

B. A brighter luminous flux count (lx) leads to increased light spread detected on objects in Lumens (lm).

C. (V1-lm), (V2-t), and (V3E-lm) contributes to greater viability (V).

METHODOLOGY

The study was conducted in order to determine the luminous flux (lx) efficiency and viability of the photoluminescent phosphor ZnS:Ag. Specifically the study aims to identify the viability of ZnS:Ag for possible application in man-made structures as an alternative to traditional street-lighting systems such as CFLs or LED technology that doesn't require the use of electricity. The researchers have selected a true-experiment design in conducting the study. It allows for the researchers to manipulate and control their testing samples or test groups in order to determine or understand processes based on pre-existing parameters set. Because of the control granted by the design, the researchers can now determine the luminous flux efficiency and viability of ZnS:Ag that ultimately answers the research questions. The testing methodology allows for full control and contingency-plans that enable the researchers to further conduct with little to no influence from outside forces, the result of the experiments to be conducted. Additionally, as the research is required to be quantitative in nature, social methodologies are thus minimized or outright forbidden. This is further justified as mathematical and scientific data alongside the use of inferential statistics to be the sole source of observed/tested data in concluding the study conducted. As aforementioned, the research, although true-experimental in nature, will follow a parametric-based testing regime to answer each individual sub question leading to the main overall question of the study. This will be reflected under the conclusion of the study.

The study contains three main phases of experimentation as specified by the research questions. The first phase involves the determination of luminous flux efficiency (lx) by direct testing through a Photo/Luxmeter. The second phase involves the empirical observation of light scatter in lumens (lm) by the photoluminescent light source. And lastly, the third phase involves the sub-testing of various parameters such as viability of surrounding lit-objects (V1-lm), visibility of luminescence endurance (V2-t), and viability of environmental luminescence (V3E-lm). Please do note that the visibility of luminescence endurance (V2-t) is taken into account in order to determine the maximum viable length of time the product is visibly observed to produce (emit) light.

Materials

The testing procedures are based on the original testing methodologies by Stepanov & Gribkovskii however modernized and adapted to fit the current research requirements. The use of a photometer in order to determine the luminous flux efficiency of ZnS:Ag as well as its viability for implementation on man-made structures was first determined by a study conducted by Rajkhowa from Lund University. The 1:25th scale ratio was determined to be the most scientifically accurate as it was compared to area-based testing rather than volumetric-based testing. The total amount of ZnS:Ag (Silver Activated- Zinc Sulfide) is 310g (± 5g) with the activator. This is because only 2 layers will be added overall to the testing platform. The thickness of each layer according to past studies is about 22.7 nanometers. With

two layers combined, that totals to 45.4 nanometers. It will be applied through an application scalpel typically used for painting. An allowance of 2 hours is given for the phosphor to adhere to the surface. It is then attached with a thin layer of polyacrylate that is proportional but single layer only to the ZnS:Ag phosphor. This is to secure the phosphor and protect it from outside influence.

The Diorama (Test Platform)

The diorama will be the main testing platform for the phosphor ZnS:Ag to be applied. It is designed to limit the amount of light entering the experimental system through enclosement. A triage of monitoring systems such as cameras and the photometer will monitor the light emitted within the enclosed system. Additionally, only sunlight (natural-sourced) will be used for comparison as any other source would be detrimental to the significance of the study determined to begin with. This is known as an "Outside-Source Secured System or OSS" for experimental testing. The cameras nor the photometers to be installed generate alien light.

Luminous Flux Efficiency (lx)

The researchers are testing for efficiency and not efficacy, the implementation of luminous flux (lx) which equates to 1 lumen (lm) per square meter was selected. With efficiency tested in light produced per square meter of area within the test platform. It is important to mention that Luminous Flux (lx) is an SI-Derived Unit that originates from Lumens (lm) in which Lumens is then derived from Candela (cd)- an SI Base Unit. The main testing apparatus used to determine such is an Argus 5000 pro-series Lux/Photometer. Approved by EOL, it is capable of testing luminous flux, lumens, and offers conversions to other SI/SI-Derived Unit for light or luminosity. Additionally, it has a built-in data logger capable of 10000 entries at 1 second intervals. This is measured from a distance of 10 cm from the test platform. A total of 3 trials are required, the average is the final result.

Parametric Viability (V)

The testing regime for Parametric Viability or simply stated as Viability is unique to the research as it aims to address multiple concerns by sub-testing. These are as aforementioned: viability of surrounding lit-objects (V1-lm), visibility of luminescence endurance (V2-t), and viability of environmental luminescence (V3E-lm).

Surrounding Lit-Objects (V1-lm)

The viability of surrounding lit-objects or stated as V1-lm aims to identify if the product is capable of lighting up surrounding objects because of the unknowns associated with the light scattering nature of the phosphor Zns:Ag. This will be done through placing test objects at various lengths within a closed and controlled system in order to determine the amount of light visibly observed. This is measured in lumens and measured from a distance of 10 cm from the test platform or area of interest. A total of 3 trials is required, the average is the final result.

Luminescence Endurance (V2-t)

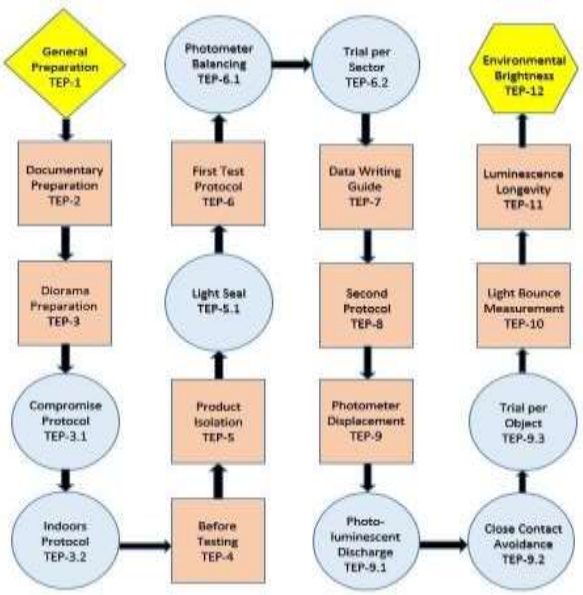
The second test is for visibility of luminescence endurance, stated as V2-t. The aim of this test is to determine how long the luminescence of ZnS:Ag lasts under photoexcitation. The test will require the product to absorb natural light for 5 continuous hours. After absorbing, the product is then enclosed once more, and the sensors take over. The sensor will be directed to measure the light source in real time as it slowly fades. A digital timer is attached and is monitored by the attached cameras. After the lumen count drops beneath "1" the product is considered as "no longer generating visible light" and the timer is thus stopped. This is measured in the following format as "Hours: Minutes: Seconds (00:00:00:000)". A total of 3 trials is required, the average is the final result. It is important to note that for the sake of visual illustrations, all times collected is converted into seconds.

Environmental Luminescence (V3E-lm)

Lastly, the third test is viability of environmental luminescence or stated as V3E-lm. The aim of this test is to determine if the light produced by the product is greater than the light produced by natural elements such as Moonlight, or Light reflected from laminated surfaces. For obvious reasons, Sun light is not taken into account as currently, Sunlight is more powerful than any source of light for public use. The test will require the use of artificial lighting to excite the ZnS:Ag phosphor, after which, the test will be done open in a clear night sky with sensors measuring the data every 1 second. This is automatically logged. The data is then averaged for the final result. This is also measured in lumens. This is measured from 32cm or 12 inches from the test

platform or area of interest. A total of 3 trials is required, the average is the final result.

Flowchart of True-Experimental Tests (TEPs)



The simplified flowchart details a clear path of the testing procedures with contingencies in the event of failure or compromise. The rhombus marks the start of the experimental procedures, and the Hexagon for the end of the experimental phase. The square shape denotes main procedures with the circles denoting sub-procedures or contingency plans.

RESULTS AND DISCUSSION

The following data displayed are raw. These are used to explain the trend visible on the graphs. For the first test, the data is recorded in Lux. But do take note that 1 Lux= 1lx (Luminous Flux). 1lx= 1 lm/m2. A conversion is thus not required, and the data can be interpreted directly. To eliminate possible disparities, a total of 173 data points were recorded (Only 163 is displayed here). And these were recorded over 30 second intervals. These total at 5,160 Seconds (±60 Seconds) of testing or approximately 86 Minutes (±1 Minute). Only the average is displayed here. The average deviation of the data is less than 1%, accuracy is thus at 99% scientific.

Table 1: Luminous Flux Testing Data (lx) in Lux

Cross Average 1	Cross Average 2	Cross Average 3	Cross Average 4	Cross Average 5	Cross Average 6	Cross Average 7
3.633333333	3.466666667	3.4	3.2	2.833333333	2.3	1.933333333
3.6	3.433333333	3.4	3.1	2.733333333	2.3	1.933333333
3.666666667	3.466666667	3.4	3.066666667	2.766666667	2.333333333	1.866666667
3.7	3.466666667	3.366666667	3.066666667	2.733333333	2.266666667	1.8
3.666666667	3.466666667	3.333333333	3.033333333	2.7	2.266666667	1.866666667
3.7	3.4	3.333333333	3.033333333	2.633333333	2.233333333	1.933333333
3.666666667	3.4	3.366666667	3.033333333	2.633333333	2.166666667	1.8
3.7	3.333333333	3.3	3	2.7	2.2	1.8
3.7	3.533333333	3.3	3.033333333	2.666666667	2.233333333	1.733333333
3.666666667	3.366666667	3.333333333	3	2.6	2.166666667	1.766666667
3.666666667	3.3	3.333333333	3	2.666666667	2.1	1.733333333
3.666666667	3.333333333	3.3	3	2.6	2.066666667	1.633333333
3.633333333	3.366666667	3.333333333	2.966666667	2.6	2.133333333	1.633333333
3.633333333	3.3	3.266666667	3	2.7	2.1	1.633333333
3.633333333	3.266666667	3.266666667	2.933333333	2.566666667	2.1	1.6
3.5	3.266666667	3.3	2.9	2.5	2.066666667	1.633333333
3.5	3.266666667	3.266666667	2.833333333	2.466666667	2.033333333	1.5
3.433333333	3.366666667	3.266666667	2.866666667	2.466666667	2.033333333	1.5
3.466666667	3.333333333	3.266666667	2.9	2.5	2	1.433333333
3.466666667	3.366666667	3.3	2.866666667	2.4	1.966666667	1.4
3.466666667	3.366666667	3.233333333	2.833333333	2.433333333	1.966666667	1.366666667
3.5	3.333333333	3.2	2.833333333	2.4	1.966666667	1.333333333
3.466666667	3.4	3.166666667	2.833333333	2.333333333	1.933333333	1.266666667

Average Deviation: 0.63072 (<1%)

Graphed Test Results

To understand the data simpler for this test. The graph below shows a decreasing curve. This is because as time goes on, the luminosity flux or lux count of each interval decreases. Now although gradual, the rate of change is not constant and is varied. This could be due to multiple factors such as particle reflection, photo sensor recalibration, and even the photoexcitation process itself. However, it is clear that the light emitted decreases over time, and this is expected by the researchers. Do note that cross average between each individual test is used in this regard to simplify the huge data set recorded.

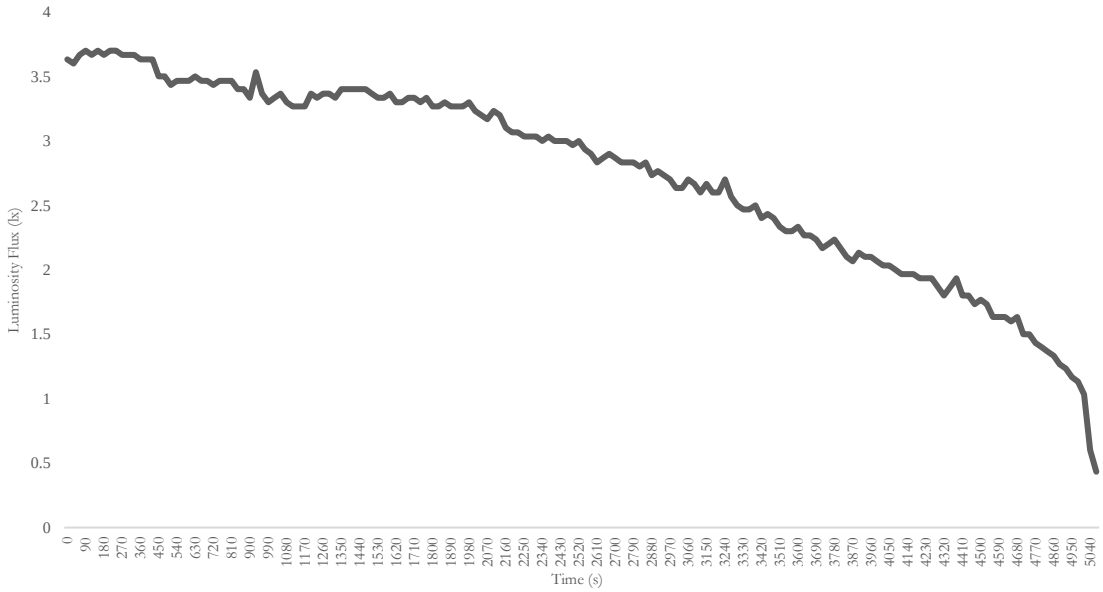


Figure 1. Luminosity Flux (lx) Cross Average Efficiency Curve over Time

In test 2, the following data has been collected. Do note that the data presented herein is recorded using a digital stopwatch. The computer is programmed to automatically stop the recording time if the detection of light or Lux of the photometer falls below 0.5. This is because a lumen/Lux count of 0.5 and below is no longer considered viable (observable) light. This was discussed by Gribkovskii in the theory of luminescence. Additionally, a total of 16 data sets were recorded (cross average). Note that it is recorded in seconds and only 11 sets are displayed.

Table 2. Viability (V2-t): Luminosity Endurance (t) Testing Data in Seconds

Trial 1	Trial 2	Trial 3	Cross Average
26901	27198	28110	27403
28102	28172	28182	28152
28212	26721	23998	26310.33333
25920	27281	28912	27371
28192	27812	28917	28307
26625	29002	27165	27597.33333
27821	28172	28192	28061.66667
25245	28918	27165	27109.33333
27821	28172	27514	27835.66667
23256	28812	27221	26429.66667
24526	29001	27219	26915.33333

Average Deviation: 723.141 seconds (12.05 Minutes). (<5%)

Unlike other phosphors, ZnS:Ag uses a highly stable structure. This stable structure allows for as little photons as possible to escape. Which means, during

photoexcitation, as photons of light enter the chemical structure, they remain as such as the phosphor or photon decays over time due to the loss of energy. As light is energy or heat, ZnS:Ag was able to absorb as much as it could, given the molecular available spacing, it slowly emits than vice versa. Additionally, the data is almost uniform in nature, which is why the phosphor is believed to be the best compound for this experimentation.

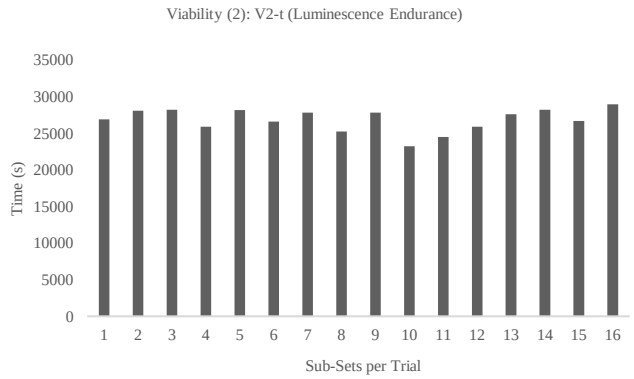


Figure 2. Viability (V2-t): Luminosity Endurance (t) trial 1

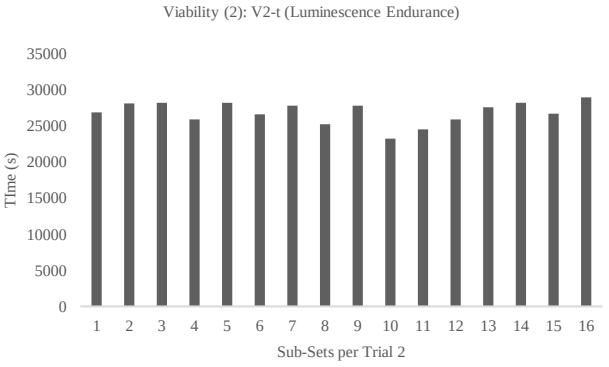


Figure 3. Viability (V2-t): Luminosity Endurance (t) trial 2

The final experimental test result shown herein is the Light Observed on Objects (V1-lm) viability. Now why is this important? For starters, it denotes that light emitted by the phosphor is bounced, reflected, absorbed by the surrounding area, or object of interest. Do note that there are a total of 21 data sets. However only 15 is displayed for simplicity. It is recorded in almost the same manner as the 1st test. The only difference is that the photometer was distanced just <10mm from the object for increased resolution. Do note the specific object associated with the data. The cross average is used as a basis for discussion.

Table 3: Viability (V1-lm): Light Observed in other Objects in Lux

Object of Interest (OIs)	Trial 1	Trial 2	Trial 3	Cross Ave
Model Car	3.92	4.01	3.89	3.94
Model Boat	3.82	3.81	3.76	3.797
Model Tree	3.57	3.56	3.91	3.68
Model Bike	3.89	3.78	3.22	3.63
Non-glass Window (Cellophane)	4.91	4.22	4.84	4.657
Water Reflection (Cellophane)	4.76	4.48	4.65	4.63
White Wall (Cardboard)	4.782	4.66	4.02	4.487
Model Grass (Foam)	3.92	3.88	3.77	3.857
Model Car (2)- With Reflectors	3.781	3.672	3.879	3.777
Model Car (3)- Black Colored	3.12	3.18	3.42	3.24
Black Wall (Cardboard)	2.48	2.38	2.08	2.313
White Wall with Black Patterns	3.88	3.76	3.69	3.777
White Wall with Reflectors	4.21	4.03	3.99	4.077
Model Table/Bench Black	2.32	2.37	2.88	2.523
Model Lantern with Glass Housing	9.12	8.74	7.922	8.594

Average Deviation: 0.79905 Lux. (<15%)

Unlike the previous tests, this test is easily understandable. Before explaining further, it is important to state that these are models. Results may vary in real life or full scale models due to use of different materials, quality of such materials, and/or natural decay or dilapidation. To explain, the researchers would like to take the water reflection, white wall, and model lantern with glass housing to compare. The water reflection was made possible due to the use of cellophane, a plastic that dissolves easily with water. This is used to simulate the effects of water with intended ripples; thus the placement is not smooth or even flat. To enhance the water effect, a dark blue sheet was placed beneath the cellophane layer. Compared to the white wall, the data is almost negligible in difference. This is because both bounce light rather than absorb and as the bounced light hits the photo sensor of the test instrument, it artificially inflates the results. But what happened with the model lantern? The model lantern has a built-in glass housing. Due to the angle of the glass elements, it created an artificial crystalline effect

and reflected the light as well as amplified it. This was a data point worth mentioning because the results are almost 3x higher than other tested objects of similar nature.

Another question that popped up. Why is there no test for V3E-lm? During the time of testing, quarantine protocols were still in effect. This made setting up of any testing installation outdoors in communities, discouraged or outright banned. However, thanks to the data collected from the first luminous flux test, an artificial simulation of what it would be when outdoors was conducted. The researchers realized that by doing so, the light source was simply not strong enough to fight out the natural light of the moon which peaked at 12.7 lux. Now, a higher concentrate of the compound could fix this result. But as for viability, the product fails in this regard. It is important to note that more research on this phenomenon is required to further justify its findings.

CONCLUSION AND RECOMMENDATION

The study was mostly successful in determining the viability and efficiency of ZnS:Ag (Silver-Activated Zinc-Sulfide) as a potential electricity-free alternative to traditional lighting sources. To summarize, the data was significant in regard to its hypotheses and has exceeded or met expectations with high accuracy and a low margin of error. Additionally, overall deviations in data sets were acceptable and are considered true-experimental. With more of the world becoming dependent on these potentially dangerous and hazardous lighting sources, it becomes a clear cause for worry. Even more so now, as we come to the 21st year of this century. Now the world has made great strides in restructuring its energy generation sources, diversifying their means of doing so, and seeking new innovative technologies that go beyond the boundaries of proven and theoretical sciences. But unless we start from the very first technologies that used electricity- i.e.: the light bulb, we are putting those efforts at waste. As far as the experimentations conducted, the data was glaring. It showed the potential for these phosphors to be used as safe and sustainable alternatives to traditional lighting sources. Over a large distance, photo excited by the sun, these have the possibility of lighting up entire cities without a drop of electricity usage. Which is fairly important for modern day, developing countries like the Philippines.

With that said, these are the following recommendations that the researchers would like to mention.

- The need for laser-based spectroscopy is essential for determining the luminous distance physically, rather than through luminous flux. Because although the conversion is 1:1, it doesn't take into account air molecules, air humidity, and/or specific light waves such as infrared, and ultraviolet spectrums.
- The need for more accurate photometers is important. Although with a maximum resolution of 100,000 Lux, the photo sensors' resolution rate at distance is poor. With a tangible 15% drop off in resolution per millimeter. This creates inaccuracies when viewed through the data gathered and is not recommended.
- The use of more realistic models is a recommendation as the models used were either made of plastic or die-cast materials such as silica, polyurethane, and polystyrene.
- An air-tight or vacuum chamber, to determine if light emitted is influenced by air molecules in a controlled experimental environment with relation to its Lux count or radiance.

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A MANIFEST CONTENT ANALYSIS STUDY OF ONLINE NEWS ARTICLES ON START-UP ENTREPRENEURIAL BUSINESS DURING COVID-19 PANDEMIC

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ABSTRACT

The current pandemic has ushered an era of innovativeness among start-up entrepreneurs worldwide. Interestingly, such a phenomenon becomes a fertile ground for different theoretical and practical inquiries. As one of the pioneering attempts to explore start-up entrepreneurial endeavors in a pandemic setting, this manifest content analysis study was conducted on select published online news articles featuring start-up entrepreneurship during the COVID-19 health crisis (March 2020 to March 2021). A total of 73 online news articles were collected in which surface features were descriptively analyzed. Notably, results revealed that among the 173 featured entrepreneurs from the online news articles, (60.12%) were females, (25.43%), young adults, (47.62%) and hailing from North America, with food service rating the highest in terms of the products/services offered (27.21%). Implications of the results of the conducted study on start-up entrepreneurial business theories and practices, limitations and recommendations were also discussed.

Keywords: start-up entrepreneurial business, online news articles, COVID entrepreneurship, COVID-19 pandemic, manifest content analysis

INTRODUCTION

On March 11, 2020, the World Health Organization (WHO) proclaimed that the Covid-19 is to be characterized as a pandemic because of the severity and the alarming amounts of cases rising up in different countries around the world. This prompted economies having to adapt to sudden changes and businesses shutting down or trying to survive the current situation. Similarly, the situation was even described as a metaphorical black swan event because of its unpredictability and severe effect on a country that drastically required changes to its environment economically and politically (Winston, 2020). It should be noted that the pandemic has led to a significant rate of unemployment with South Africa as the hardest hit (28.5%) and an unprecedented 20.5 million jobs shed as the pandemic hit the economy (Williams, 2021; Chaney & Morath, 2020).

Although start-up businesses become a viable option to earn an income during the health crisis, start-ups could be the most vulnerable in any economy (Walsh & Cunningham, 2016) and with the pandemic ongoing, chances of starting a successful startup are slim. A tragedy like the COVID-19 pandemic may jeopardize a business' ability to survive and succeed (Boin, 2009; Comfort, 2002; Quarantelli, 1988; Williams et al., 2017). Moreover, a study by Kuckertz et al. (2020) suggests that the government's response on lockdown and the pandemic can possibly affect startups that are trying

to leverage the damage of the pandemic that has been brought to their businesses.

While it is true that the current pandemic may have detrimental impacts to entrepreneurial pursuits, it is also interesting to note that COVID-19 health crisis also offered opportunities for start-up entrepreneurs to arise hence this qualitative investigation was conducted which seeks to explore global start-up entrepreneurial businesses during the COVID-19 pandemic via manifest content analysis of online news articles. Findings of this investigation may provide impetus on further exploring topics related to entrepreneurship specially in a pandemic context which remains a unchartered territory in research.

Theoretical Background

Theoretical framing

This qualitative study draws on the Effectuation Theory of Entrepreneurship (ETE) (2001) to identify emerging start-up entrepreneurial business during the COVID-19 pandemic. The theory is described as the process that entrepreneurs use to create new ventures and involves analyzing current resources and then deriving expectation from what can be made from the recombination of those assets (Sarasvathy, 2001). Impliedly, the global entrepreneurs found the current pandemic not as a hindrance, but instead, a viable opportunity to venture into new entrepreneurial pursuits via thorough evaluation of the affordances of their current resources and situation and setting realistic outcomes. Notably, ETE was utilized in studies on entrepreneurship such as those of Matalamäki (2017) which identified stages of development of ETE among entrepreneurs, and Fisher (2012) that provides a critical examination of how different theoretical perspectives in entrepreneurship research by using the theories of effectuation, causation, and bricolage, among others.

Literature Review

Covid-19 Entrepreneurship

According to Ratten & Jones (2021), in the time of pandemic, an entrepreneurial analysis is needed due to major changes in human lifestyle, culture, and social interactions. Remarkably, several studies found that Covid-19 pandemic influenced the entrepreneurs on how to respond in many aspects and became part of entrepreneurship. Such in the way of using technologies for a vital part of a business-like e-wallets (Aji et al., 2020), digitalized firm (Priyono et al., 2020), and technologies as the main driver of innovation of entrepreneurs (Razumovskaia et al., 2020). It also shows how strategic management plays a crucial role for entrepreneurship in a way of guidance to handle risks (Liguori & Pittz, 2020), concepts from multiple fields from a managerial perspective (Ketchen & Craighead, 2020), marketing strategies (Crick, 2020a & Crick, 2020b), and strategic agility for businesses and organizations to succeed (Liu et al., 2020). Moreover, Covid-19 has brought a lot of impact to the entrepreneurs and their businesses such as on start-ups and global economy (Salamzadeh & Dana, 2020), small businesses (Bartik et al., 2020), and business economy (Portuguez Castro & Gómez Zermeño, 2020). Its impact can also be seen in areas such as crisis management (Ratten, 2020), on the market for entrepreneurial finance (Brown, et.al, 2020), and sports entrepreneurship (Escamilla-Fajardo et al., 2020). However, many studies also believed that there are effects of Covid-19 on small businesses and entrepreneurs (Fairlie, 2020), and self-employed workers (Beland et al., 2020). Moreover, Dy et al. (2020) and Grandy et al. (2020) also punctuated the effects of Covid-19 on women-owned business and women entrepreneurs. These studies strengthen Ratten & Jones' (2021) previous assertion of the pandemic's effect across different types and aspects of entrepreneurial business. It should be pointed out, however, that studies about Covid-19 entrepreneurship on start-up business are seldom explored, hence this investigation.

Start-Up Business

According to Gartner et al. (2004), individual actions, behaviors, and achievements that contribute to the creation of new businesses are referred to as start-up businesses. Remarkably, several studies showed different factors or strategies of start-up entrepreneurs that lead to create new effective and successful ventures. Such factors include fear, education tools, and decision aids (Nabi & Liñán, 2013), customer values, skills in marketing, conversion of the interest, and satisfaction of customers (Slávik, 2019), studying the diversity of cultures of knowledge production and their relations to their respective contexts (Fochler, 2016), and multilevel mechanisms (Åmo, 2013). In addition, it is also mentioned that using social media such as customer collaboration (Laage-Hellman et al., 2018), reviewing positive, negative, and neutral comments to give customer satisfaction (Saura et al., 2019), talking to customers, collecting pre-orders and pivoting based on customer

feedback (Welter et al., 2021) influences the innovation and service of start-up entrepreneurs. Moreover, to be able to maintain the quality and effectiveness of start-up businesses' business models, by rapidly strengthening the required degree of efficiency (Balboni et al., 2019), analyzing the implementation of the project experiments of the project and maximizing the learning on challenges and opportunities (Weissbrod & Bocken, 2017), and promoting tech start-ups across the global economy (Mungila Hillemane et al., 2019) are considered by entrepreneurs. Intriguingly, gender was found to have an influence towards the entrepreneurial behavior of an entrepreneur. Hazudin et al. (2015) as well as Kremel and Yazdanfar (2015), explained that female entrepreneurs may possibly experience challenges in entrepreneurship due to lack of knowledge and skills. Therefore, female entrepreneurs sought more business advice. According to Van der Westhuizen & Goyayi (2019) and Hazudin et al. (2015), male entrepreneurs may possibly experience challenges in entrepreneurship because of corruption, yet self- efficacy among male entrepreneurs were found along with having a higher skill set in starting an online business. Notably, different approaches such as entrepreneurship training (Olugbola, 2017), business training programs (De Mel et al., 2014), entrepreneurship schooling (Gonzalez-Uribe & Leatherbee, 2017) and parental entrepreneurship (Behrenz et al., 2016) may be implemented to cultivate young entrepreneurs regardless of genders.

METHODS

Research Design

This study employed Manifest Content Analysis (MCA) as its research design. According to Kondracki et al. (2002), manifest content can be discovered in using coding and keyword searches and can be recorded in frequencies including word counts. In addition, MCA is the analysis of what the data text says, deals with the content aspect, and explains the visible obvious components, also known as manifest content (Downe-Wamboldt, 1992; Kondracki et al., 2002). Interestingly, several studies have applied MCA as a research design such as those about online public sentiments (Su, et al., 2016), web media and online news content (Sjøvaag & Stavelin, 2012), world wide web (McMillan, 2000), sports newspaper to examine the gender (Pedersen, et.al, 2003), and newspaper articles of crimes (Taylor, 2009).

Data collection and analysis

The researchers utilized summative content analysis or also known as manifest content analysis (Profile Tree, 2021). The summative content is a type of analysis that involves counting and comparisons, usually of keywords or content (Hsieh, 2005). To be able to look for data (news articles) that is relevant to the topic and can be counted and compared, the researchers used Google. Google, which is the most used search engine, has shown to provide better results than the commercial search engines according to Brin and Page (2012). To compile online news articles about start-up business during the pandemic through google search engine, phrases that include the terms start-up business, new business, during the pandemic, during covid-19, the pandemic, and new entrepreneurs were used. To effectively gather online news articles, a criterion was followed by the researchers: (a) the article must be published between March 2020 and March 2021; (b) the business must start between the 2020 pre-pandemic and up to date; and (c) the article must include the name and product/ service offered by the business.

However, it should be noted that news titles can be sometimes misleading (Ghazali, 2015); therefore, to confirm if the online news articles are eligible to be included in the study, the contents of the articles were carefully read by the researchers while keeping in mind the criteria listed. Descriptive analysis was utilized by the researchers to analyze the surface data from the collected articles. The online news articles are then grouped and tallied based on the month it was published. The accumulated information such as the total number of entrepreneurs, age, gender, ethnicity, and products/services provided by the business from the online news articles were also grouped into their respective categories. Lastly, the interpretation of the results is presented in the results section of the study.

RESULTS

Total number of entrepreneurs and online news articles collected

As indicated below, most of the entrepreneurs who started their business while in the midst of a pandemic peaked during September 2020 which has 17.34% and March 2021 that has 16.76%, followed by the month of October 2020 and

February 2021 which are tied at 11.56%. For August and November 2020, both have 7.51%, January 2021 has 6.94%, July 2020 and December 2020 are also tied at 4.62%. These were followed by May 2020 which has 4.05%, June 2020 which contains 3.47%, and April 2020 which contains 2.31%. Meanwhile, the least number of entrepreneurs are in the N/A category having 1.16% and the month of March 2020 which has 0.58%.

On the other hand, the most number of news articles are in the months of September 2020 and March 2021 having the highest percentage of 14.86%, followed by the month of February 2021 having 12.16%, January 2021 having 10.81%, October 2020 having 9.46% , June 2020 and November 2020 are tied at having 8.11%, August 2020 and December 2020 are also tied at having 5.41%, May 2020 having 4.05%, July 2020 having 2.70%, and the months of March and April 2020 having the fewest number of news articles with a percentage of 1.35%.

Table 1. The total number of entrepreneurs and news articles from March 2020 - March 2021

Month	Entrepreneurs (n =173)	%	News Articles (n=73)	%
March 2020	1	0.58	1	1.35
April 2020	4	2.31	1	1.35
May 2020	7	4.05	3	4.05
June 2020	6	3.47	6	8.11
July 2020	8	4.62	2	2.70
August 2020	13	7.51	4	5.41
September 2020	30	17.34	11	14.86
October 2020	20	11.56	7	9.46
November 2020	13	7.51	6	8.11
December 2020	8	4.62	4	5.41
January 2021	12	6.94	8	10.81
February 2021	20	11.56	9	12.16
March 2021	29	16.76	11	14.86
N/A	2	1.16	-	-

Age of entrepreneurs from news articles

Table 2 indicates the total number of entrepreneurs based on their age when the articles were published. The highest number of entrepreneurs with 63.01% falls under the Unidentified or N/A age category. It was followed by the young adults age category with 25.43%. the middle-aged adults age category with 5.20%, the young age category with 2.89%, the toddler/kids with 2.31%, and lastly, the older adults age category with only 1.16%.

Table 2. Total number of entrepreneurs based on their ages when the news articles were published (n=173)

Group	Age Range	N= 173	%
Toddler/ Kids	1-12	4	2.31
Young	13-19	5	2.89
Young Adults	20-35	44	25.43
Middle Aged Adults	36-55	9	5.20
Older Adults	56 and Above	2	1.16
N/A	-	109	63.01

Ethnicity of entrepreneurs from news articles

The table below shows the number of entrepreneurs mentioned in news articles based on where continent they are or what ethnicity they belong to. Most entrepreneurs are from North America which has 47.62%, followed by Europe which has 23.13%, Unidentified ones has 19.73%, Asia has 7.48%. The continent which has the least number of entrepreneurs are from Australia & Oceania that has 1.36% and Africa with only 0.68%.

Table 3. Number of entrepreneurs from news online articles based on from where continent they are from or what ethnicity they belong to (n=147)

Ethnicity (Country of Origin)	N=147	%
Asia	11	7.48
North America	70	47.62
Africa	1	0.68
Europe	34	23.13
Australia & Oceania	2	1.36
N/A	29	19.73

Gender of entrepreneurs from news articles

Table 4 presents the gender of the entrepreneurs mentioned in online news articles. As indicated, most of the entrepreneurs are Female which makes up 60.12%, followed by male entrepreneurs which has 38.15%, and the least

gender with the least percentage is the unidentified gender or N/A with 1.73%.

Table 4. The gender of the entrepreneurs mentioned in online news articles (n=173)

Gender	N=173	%
Female	104	60.12
Male	66	38.15
N/A	3	1.73

Products/services offered by businesses stated from the news articles

The table below shows the products/services offered by businesses based on the online news articles. The most striking products and services are no other than Food Services which contains 27.21%, next is Business Inquiries Services which has 17.01%, Fashion Services 12.93%, Online Services which has 8.16% and Machineries. The Collection of Flowers and Candles and Art and Photography Services tied with having 6.80%, Entertainment and Delivery Services with 3.40%, Medical/Hygiene Kits with 2.72%, Treatment/Therapy with 2.04% and, lastly, the least striking products and services are Pet's Needs with 1.36%.

Table 5. The products/services offered by businesses based from online news articles (n=147)

Category	N=147	%
Treatment/Therapy	3	2.04
Online Services	12	8.16
Delivery Services	5	3.40
Fashion Services	19	12.93
Food Services	40	27.21
Entertainment	5	3.40
Medical/Hygiene Kits	4	2.72
Machineries	12	8.16
Pet's Needs	2	1.36
Business Inquiries Services	25	17.01
Collection of Flowers and Candles	10	6.80
Art and Photography Services	10	6.80

DISCUSSION

Noteworthily, results of this study show that the online news articles about the entrepreneurs who started a business during the pandemic were primarily published during the months of September 2020 and March 2021 with a total of 173 entrepreneurs. It appears to be that online media systems and websites may have suggested an easier and unique source of knowledge on current business events (Westerman et al., 2013). Given the situation that we had in the year 2020, the discovery and spread of Covid-19 led to drastic measures and exogenous shocks to the innovative start-ups (Kuckertz et al., 2020). It suggests that societal factors are being fundamentally changed. How entrepreneurs respond to the Covid-19 crisis and what constitutes success in terms of entrepreneurship are the center of attention (Ratten, 2020). Despite this, the number of studies published between September 2020 to March 2021 may suggest the possibility that businesses were able to adapt and create solutions to either continue or transform their business models to possibly fit the current situation that all are struggling today. The pandemic might have opened the doors to creative ways to purchase online and get their items through delivery services of the businesses. While the pandemic affected the state of entrepreneurship, it also resulted in many new inventions and businesses.

The most highlighted part in the collection of online news articles in the category of age group and ethnicity are the young adults in North America. Accordingly, North America has its own particularities (Cho et al., 2020). Studies believe that half of American teenagers nearly say that they want to start their own company (Gallup & Operation Hope, 2012). Theoretical theories about age may point in two directions. On one hand, it has been discovered that age has a positive effect on an individual's proclivity for self-employment (Van Praag, 2003). Since experience increases with age, younger people have more human resources and are, thus, better able to spot opportunities (Bosma et al., 2004). Furthermore, younger people have more financial and social capital, both of which are essential facilitators of self-employment.

Notably, in online news articles that were collected in the months of March 2020 to March 2021, majority of entrepreneurship businesses were owned by females. They are stepping back from the traditional economic roles and are starting to have a business (Coughlin & Thomas, 2002). Women are beginning enterprises at increasing rates, and they collectively contribute significantly to the global economy (Allen et al., 2007). As indicated in the study of Kelley et al.

(2017) and Verheul et al. (2006), there are an estimated 163 million women around the world who are involved in new business ventures. Moreover, the study suggests that it has gender differences that may have an impact in women and men performance in business because they have different personal beliefs or values that can lead to different strategies that can influence them (Boohene et al., 2008) but most of the studies believe that women's rate in the business industry, especially in self-employment, have recently been greater in women than men (Hisrich & Brush, 1984). Hence, there are different findings in several studies that show that gender differences may affect how they respond, handle, and to be successful in businesses.

Remarkably, the online news articles collected from March 2020 to March 2021 have shown that start-up businesses offer a diversity of products and services but the most common is food services. It seems that food services may have used technology to their advantage through the means of online delivery platforms to be able to sell their products to their consumers (Mehrolia et al., 2020). Some food businesses utilized this strategy to operate during the pandemic. Online food delivery by food services would still be a beneficial way to help the business as consumers shifted to home delivery, as primarily restaurants require strict social distancing measures (Goddard, 2020). In 2018, companies like Amazon had started online grocery shopping as an optional way to shop for essential items (Brown, 2018) and this early investment in e-commerce might surely be helpful in times of the pandemic to help consumers with their essential needs like food. With the possible rise of smart technologies like drones, it could enable and create contactless environments to conduct and have food delivery services for the safety of its consumers (Graeme, 2020; Zeng et al., 2020). Such findings help see the rise of the number in food service businesses that started and continued during the pandemic. This may also be a reason behind the rise of start-up businesses in food as certain technologies help in selling and delivering food to its consumers as a way to financially cope with the problems the pandemic has brought.

CONCLUSION

The main purpose of this study lies in the means of start-up businesses during the COVID-19 pandemic. Specifically, the online news article gathered under the manifest content analysis study provided preliminary insights on start-up entrepreneurial business. Notably, results revealed that among the 173 featured entrepreneurs from the online news articles, most were females (60.12%), young adults (25.43%), and hailing from North America (47.62%), with food service rating the highest in terms of the products/services offered (27.21%). However, as the study is focused on the surface analysis of the gathered data and the context given, it cannot determine the success rate of entrepreneurial businesses. Hence, as start-up businesses evolve to adapt to the current situation, innovative efforts in technology have been made to help businesses to continue to provide services. In which, it could be beneficial to further help startups and other businesses to remain competitive and afloat in this pandemic.

LIMITATIONS AND RECOMMENDATIONS

This study has certain limitations. The researchers utilized manifest content analysis (MCA) as it is the most suitable design to conduct the study given the situation we have right now; the Covid-19 pandemic. So, in using the design the researchers are limited to what is observable in the study. In addition, the data sets were only given a descriptive treatment, in which uses percentage and frequencies. The researchers recommend utilizing latent content analysis (LCA) to acquire more information such as the intentions and purpose of the new entrepreneurs in creating a new venture. In relation to this, studies relating to government support towards start-up entrepreneurship and businesses may also be explored (Meyer,2015).

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DAKILA "GO FAR WITH ABACA": A BUSINESS VENTURE

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ABSTRACT

The amount of plastic and other trash produced by the sudden emergence and demand for face masks is immeasurable, as these masks are intended to be used only once. As a result, thousands of tons of additional waste will be disposed of at a landfill. To address this, the proposed business venture "Dakila" acknowledges the need for a solution to the challenge of reducing plastic waste by using eco-friendly local abaca products. The study aims to create an abaca face mask employing abaca fiber as an alternative to synthetic or polypropylene face masks. A research study showed by the DOST – Department of Science and Technology recommends ducting standard tests by accredited institutions and further R&D on the potential of abaca handmade paper as a material component of face masks. The proponent conducted actual market research utilizing an online survey and interview to potential suppliers and target customers to estimate demand data and compute for the projected market potential using smoothing techniques. Financial analysis based on the production capacity and operational costs to be incurred were considered to project a viable and profitable 3-year projected business plan. According to the findings of the study, abaca face masks are safe as an alternative biodegradable face mask for humans. The proposed business venture has the potential to be commercialized to its target market, and with the needed capitalization requirement, the business shall earn a good return of investment. Apart from giving better protection, it will also help in making a distinction in the Philippine economy by helping abaca agriculturists, social entrepreneurs, and their workers.

Keywords: Abaca, Abaca Fiber, Artificial Fiber, Banana Tree, Synthetic, Polypropylene face masks, Business Plan

INTRODUCTION

As the coronavirus disease 2019 continues, face masks are being utilized by people to restrain the spread of COVID-19 in nations around the world. With this sudden onset and requirement for face masks, the rise sum of plastic and other waste produced is immeasurable because these masks are designed to be utilized just once. This incidentally means that thousands of tons of additional waste are going to the landfill.

Because of this issue, this paper supports to advance the use of reusable-face mask made from a 100% eco-friendly, biodegradable material and is demonstrated to have a 7x better filtration than others, a sustainable product that is made from the finest abaca leaf fibers and is claimed to be the most grounded natural fiber within the world and can be proven to be certified and accredited over artificial fibers such as plastics comparable to a plant just like the banana tree. The Philippine Abaca plays a crucial part in the advocacy for environmental security and forest preservation. It is widely known for having stronger qualities over other raw materials, including other abaca, and other engineered materials by different industries throughout the world.

Dakila recognizes that there is a need for the problem of lessening the plastic waste by utilizing the local abaca products. As nations have been progressively concerned with natural awareness and are proceeding to eradicate the use of plastics and polypropylene, they are now ought to be replaced with materials of natural fiber materials due to their strength

and recyclability. Apart from giving a better protection, it will also help in making a distinction in the Philippine economy by helping abaca agriculturists, social entrepreneurs, and their workers. The study therefore aims to create an abaca face mask employing abaca fiber as an alternative to synthetic or polypropylene face masks. thus, this business venture DAKILA: A Go far for Abaca.

Name of the Company: "DAKILA"

The business is called, "Dakila." The name, Dakila is a name that suits the material of the product which is the abaca. In this time of pandemic outbreak, local products are now participating in the market. It shows that the innovation and creativity of every Filipinos are not stopped by the pandemic but instead it leads them to more doors of opportunities and every Filipinos are pleased to take and advantage of it. As most industries are now shifting to organic and local materials, the opportunities for the Abaca sector are continuously growing and receiving limitless chances. The purpose of the business name is to convey a message to the people to treat our local products especially the abaca as something mighty or "dakila." The name Dakila is mainly encouraged by those farmers who work hard and persevere while maintaining their health and safety from the virus. It also represents the wonders of abaca as it can be used in a wide variety of products.

Figure 1. Dakila Logo with Slogan

The company's main slogan is "Go far with abaca". This slogan describes and defines the usage of Abaca as the filtration for face mask. The inspiration behind the slogan is that you can go far with abaca because of its nature as the strongest among all-natural fibers and having superior qualities over other materials that made it as a 100% eco-friendly, biodegradable material, a sustainable product and is p roven to have a 7x better filtration than others. The product of Dakila is not entering the market for nothing. It can serve as an eco-friendly alternative to disposables.

Product Offering

Dagtum or Black

Bughaw or Blue

Kayumanggi or Brown

Kunig or Yellow

Lungti or Green

Figure 2. Abaca Face Mask

Abaca Face Mask concentrates on using the finest abaca leaf fibers as a filter on face masks that can serve as a locally alternative mask for the customers. Dakila will offer a variety of colors such as: Black, Brown, Beige, Yellow and Green. That is why the brand name of every product are the Filipino language of each color. It also has an adjustable clip to achieve a neat and comfortable mask fit. Dakila will also offer 3 sizes of face masks from small, medium, and large. This is to make sure that consumers are protected from the droplets in the air.

Marketing Plan Highlights

Dakila will start its marketing strategy by preparing for its product packaging. Since the product is made from the finest abaca fiber materials and were processed into special filters

and made into face masks, it is packaging will also be eco-friendly and will be beneficial to the customers. It will use a string pouch that is made from katsa, it will also be served as the holder of the face mask once they use it on their everyday use. It will be placed on the corrugated box as its final packaging and will also insert a thank you cards and instructions on how to properly wash the abaca face mask.

Dakila will offer a variety of colors such as: Black, Brown, Beige, Yellow and Green. These colors symbolize simplicity and balance as it is significant to the Filipinos. That is why the brand name of every product are the Filipino language of each color.

Dakila will be utilizing the online platform to deliver knowledge about its products; thus, the brand will have Facebook and Instagram accounts. With the help of these social media platforms, the brand will have a broader scope of the market that can be reached through digital interaction and transparency. This marketing strategy is an effective way for the small business to advertise its products.

Lastly, the customer service of Dakila will ensure that it will reach a 100% fast response rate. This is because the owner will expect several inquiries about the abaca filter mask as it is new to the market. Dakila will provide them the assurance they need that both the material and product are safe and natural.

Product/Operation Plan Highlights

Dakila will have its supplier from Bicol Region specifically, Legazpi, Albay. It is one of the regions who is known for producing abaca fibers. Materials will be shipped through a delivery courier to Tondo, Manila as the home-based business location.

Dakila will have its operations at 610 B. Coral St. Tondo, Manila. This operational place would be done at the residence of the owner. This was the location selected because it surrounds a wide range of target markets that the Dakila will caters. In terms of operations, the proper sanitation and quality protocols will be followed. Every abaca face mask will undergo a sanitizing by washing and disinfecting through alcohol.

Dakila will operate its business from Monday – Sunday and will be done through the new normal setup where businesses are operating from home. Dakila will operate from 8:00 AM and will end at 8:00 PM. This includes the ordering, listing of orders for inventory, packaging, and delivery. The business will deliver its products every weekend since the owner is conducting her online classes on weekdays. The delivery method will be from Mr. Speedy, Lalamove, JT&T or any cheap delivery services.

Organization Plan Highlights

Dakila is a sole proprietorship type of business owned by the Ms. Rhodora Andrea Yumol as she will be responsible for the decision making, financial, operations, obligations, production, operation, and marketing strategy. The business focuses mainly on outsourcing from its supplier, namely, Abaca Face Mask Direct Supplier as a start-up business.

Financial Plan Highlights

The initial capitalization of Dakila was amounting to Php 30,000.00 which will be used for pre-operating expenses. Dakila will stock a 100 pieces of abaca face masks that varies in 5 different colors. Each color will be having a 20 pieces stocks and the remaining 10 pieces will be used for marketing promotion specifically in photography materials and will also serve as a sample product.

This money will be used for the business to start its operations. Purchase of equipment, supplies, raw materials, and other expenses such as utilities and taxes will also be considered to start the business' operations. Projected sales were identified, and percentages were greatly considered for the coming years' figures.

Socio-Economic Contribution

Dakila recognizes the worsening problem of climate change due to plastic waste that results from sudden usage of face masks. With that, Dakila wants to serve its purpose and mission which is to propose a sustainable alternative product that has been proven to serve a new purpose in reusable face masks that are much-needed during the COVID-19 pandemic and moving away from plastics and other synthetic materials.

To improve the problem about face mask disposal, the Department of Environment and Natural Resources (DENR) advises the public to use a reusable face mask and manage their trash at home. The use of abaca fiber as filter and it shows that the abaca face cover has a filtration rate that is seven times better than cloth masks. It also has lower water absorption than N95 masks. The abaca face masks can be

reused after it has been washed with water and soap as studied by The Department of Science and Technology (DOST) Region 10. Additionally, once it is thrown away, decomposition will be faster. As no plastics or chemicals were used in its fabrication; it will not harm the environment.

It can also help the local farmers who were heavily affected by this pandemic as the major source of their income become weaker. By producing such abaca filter masks sourced from them, their livelihood will boost again once the market patronage this product. This is the time where every Filipinos should support and start believing in local products as much as we support the international products.

Lastly, Dakila will be a 100% plastic free from the materials up to the packaging. As we are advocating the use of sustainable and biodegradable products, this is because Dakila aspires to be a part of the solution and not the problem.

Literature Review

The Department of Science and Technology-X (DOST-X) has formed several action teams and launched a few S&T projects to assist government and non-government organizations in addressing the health crisis caused by the COVID-19 pandemic. DOST-X has accepted several varieties of cloths and face masks made from various materials supplied by local vendors in the city commencing April 2020, in response to repeated requests. RSTL used basic Water Drop Tests and Laboratory-Modified Water Drop Tests to evaluate the material's water repellence and absorbency, and Microscopy to analyze fiber structures and estimate pore sizes.

The Philippine Textile and Research Institute's "A Face Mask Resource Kit" includes a simple Water Drop Testing method for testing a fabric's or material's capacity to withstand water (DOST-PTRI). While the Laboratory-Modified Water Drop Test is an in-house adaption of the Water Repellence: Spray Test developed by the American Association of Textile Chemists and Colourists (AATCC TM22), The microscopy results revealed pore size data and a description of the fiber configuration, implying that the abaca-made face mask has pore sizes ranging from 10-70m and larger fibers than the surgical and N95 mask materials. It has a medium to tight configuration as well.

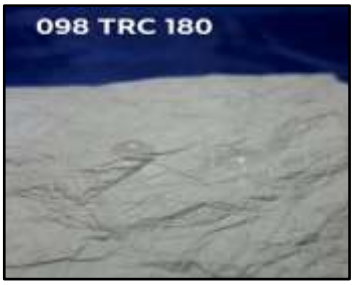

Figure 3. Abaca handmade paper with the bead of water observed after 30 minutes

The findings of the basic Water Drop Test showed that the abaca-made face mask did not produce repellent since it failed to produce a well-defined bead of water inside and after at least 30 seconds. The surgical face mask was used to create the repellent.

Figure 4. Abaca handmade paper with the mark of water absorbed after a few minutes

According to the results of the simple Laboratory-Modified Water Drop Test experiment, the abaca-made mask absorbed three to five percent (3-5 percent), the N95 mask absorbed forty-six percent (46 percent), and the surgical face mask absorbed 0.17% of the total volume of water dispensed.

Figure 5. Abaca-made facemask inside an analytical balance weighed after dispensing of water

Despite using the best of its available resources to investigate the materials for hand-made face masks, DOST-X is continually extending its ability to perform the standard tests required by regulatory agencies. The results of the

parameter-based evaluation do not reflect the samples' filtering efficiency or filter performance.

Because abaca handmade paper is locally available and environmentally safe, the DOST-X advises standard testing by accredited institutions, as well as additional research and development on the potential of abaca handmade paper as a material component of face masks.

METHODOLOGY

Research Design

The term "mixed methods" refers to a research approach that fosters the systematic integration, or "mixing," of quantitative and qualitative data within a single study or long-term program of investigation. The key concept of this methodology is that such integration allows for a more comprehensive and synergistic use of data than separate quantitative and qualitative data collection and analysis.

This method was used to determine whether the abaca face mask would be appropriate for each respondent's needs, and it aimed to determine whether this could address the consumer's needs for face masks that will assist them in preventing and protecting themselves from the virus by patronizing this alternative face mask that seeks sustainability, recyclability, an affordable price, and fibers that can help consumers protect themselves from droplets and air contamination, the use of abaca face mask.

Target Market

Table 1. Target Market Indicators

Target Market Indicators	Specific Target Market for Dakila
Age	• 20 years old to 30 years old
Employment	• Students and Young Professionals
Behavioral	• Going outside while Enhanced Community Quarantine • Buying through Online Platforms
Psychological	• Average Spenders from ₱ 120.00 – ₱ 150.00 • Eco-friendly enthusiast • Willing to buy Abaca Face Mask

Table 1 shows the distribution of respondents in each indicator, which has been coded to ensure anonymity. Dakila's primary target market will be students and professionals between the ages of 20 and 30. They have been compensated and have a good income, so they can afford the product offerings. Aside from that, these are the ones that are always looking for ways to save time.

Of the respondents in the survey, 18% percent were 15 years old to 19 years old and 82% for 20 years old to 30 years old. There were 0 respondents who are ranging from 31 years old to 51 years and above. In addition, 61% in the survey were Female, 31% were Male, and 1% goes for binary.

Respondents are students, young professionals, and workers as potential target market. With this consideration, the company can reach them quickly and provide its product offering.

Procedure

The researcher individually distributed the survey questionnaire via the online platform. The study began in the second semester of AY 2019-2020 and was collected after days of giving students the opportunity to explain things that were unfamiliar to them before responding to the questionnaire. Following the approval of the Business Plan Adviser, the researcher distributed the questionnaire to the respondents individually. Despite the fact that students have the option of responding or not, the proponent guarantees ethical consideration whereby all responses will be used strictly only for the business research and will be kept private and confidential.

Instrument of the Study

The survey questionnaire was used as the study's tool. A survey questionnaire is a research tool for gathering data from a predefined set of respondents in order to get information and insights on a variety of topics of interest. It comprises a series of questions designed to elicit information from respondents particularly demand and marketing data.

The questionnaire is divided into two sections: Part I focused on respondents' personal attributes such as age, gender, employment, income, use of a face mask when going outside, and the amount to which they went outside when the Enhanced Community Quarantine was in effect. Part II of the questionnaire was used to answer the questions raised in the amount of face mask usage and focused on the critical

components of abaca face mask. The items were compiled based on current scenarios about the best practices for purchasing a face mask. This questionnaire includes the following factors: Demographic Profile, Behavioral Profile, and Psychological Profile to segment potential market.

Data Processing

As for the Demand and Supply, the following processes are employed. For the Demand Analysis, the proponent computed for the Total Projected Demand for the next 3 years where it uses the growth rate 1.43% within Manila in the year 2015 with a target percentage of 71% which range from 20 yrs. old – 30 yrs. old.

The acceptance rate is 11% that came from the segmented factors such as Age, Employment, Income, going outside while Quarantine, where do they buy their face mask, price preferred, criteria in purchasing a Face Mask, and their willingness to buy the Abaca Face Mask.

For the Supply Analysis, the computation of the Supply from the direct competitors. It uses a process of getting the total supply of each direct competitor then multiplying on its assumed market share. With that, the proponent can now proceed to the Demand and Supply Analysis.

The Demand and Supply Analysis illustrates the projected sales in volume of Dakila in the next three years. Using the past year's sales data of the competitors, the proposed business has assumed a 3% intended market share for 2021 to project the sales since it is a new entrant in the market aligned with its production capacity. Employing the proposed marketing strategies and programs, the business is expected to increase its market share by 5%, and 6% for 2022 and 2023 respectively considering that the business is a small-scale enterprise.

RESULTS AND DISCUSSION

Demand and Supply Analysis

Table 2 shows the computation for the estimated Total Projected Demand for the next 3 years where it uses the growth rate 1.43% within Manila in the year 2015. For the year of 2021, with a population of 1, 938, 287 and with a target segmented percentage of 71% which range from 20 yrs. old – 30 yrs. old that result to 1, 376, 184. The acceptance rate is 11% that came from the segmented factors such as Age, Employment, Income, going outside while Quarantine, where do they buy their face mask, price preferred, criteria in purchasing a Face Mask, and their willingness to buy the Abaca Face Mask. For 2021, the projected demand is 151, 380 while for the year of 2021, the projected demand is 153, 545. Lastly, the projected demand for 2023 is 155, 741.

Table 2. Total Projected Demand for next 3 years

Year	Population	Proposed Target Segment (71%)	Acceptance Rate (11%)	Projected Demand
2021	1, 938, 287	1, 376, 184	11%	151, 380
2022	1, 966, 005	1, 395, 863	11%	153, 545
2023	1, 994, 119	1, 415, 825	11%	155, 741

Projected Sales

In table 3 is the computation of the Potential Supply Schedule for 2021 of the direct competitors. For Fililiogy, the number of face masks sold per day is 6 with an operating day of 7 days and 52 weeks. The number of stores within the vicinity is 1 that leads for having a supply of 2,184.

For Eco Stuff, the number of face masks sold per day is 8 with an operating day of 7 days and 52 weeks. The number of stores within the vicinity is 1 that leads for having a supply of 2, 912. For Hiraya Pilipina, the number of face masks sold per day is 5,824 with an operating day of 7 days and 52 weeks. The number of stores within the vicinity is 1 that leads for having a supply of 5, 824. Overall, the potential supply schedule for 2021 is 10,920.

Table 3. Potential Supply Schedule for 2021

Competitors	No. of Face Masks sold per day	No. of Operating Days	No. of Weeks	No. of stores within the vicinity	Supply
Fililiogy	6	7	52	1	2, 184
Eco Stuff	8	7	52	1	2, 912
Hiraya Pilipina	16	7	52	1	5, 824
		Total			**10, 920**

Demand-Supply Gap Analysis

Table 4 illustrates the projected sales in volume of Dakila in the next three years. Using the past year's sales data of the competitors, the proposed business has assumed a 3%

market share for 2021 to project the sales since it is a new entrant in the market. Employing the proposed marketing strategies and programs, the business is expected to increase its market share by 5%, and 6% for 2022 and 2023 respectively considering that the business is a small-scale enterprise.

Table 4. Demand and Supply Gap Analysis for 3 years

Year	Potential Demand	Potential Supply	Demand-Supply Gap	Market Share	Total Projected Sales in Volume
2021	2, 214, 690	10, 920	2, 203, 770	3%	6,720
2022	2, 246, 363	11, 076	2, 235, 287	5%	10, 080
2023	2, 278, 490	11,243	2, 267, 247	6%	13,440

Table 5 is the computation of the Total Sales in a Month for 2023. For Xs-Small sizes, the projected sales in volume are 6,720 with a selling price of 143.33. If we multiply it, the total sales in a year are 963,178 that leads for having a sale in a month of 80,264. For Medium-Large, the projected sales in volume are 6,720 with a selling price of 165.38. If we multiply it, the total sales in a year are 1,111,354 that leads for having a sale in a month of 92,612.

Table 5. Projected Sales in Volume and Peso for year 2023

Products	Projected Sales in Volume	Selling Price	Total Sales in a year	Total Sales in a month
Abaca Face Mask (Xs- Small) 50%	6,720	143.33	963,178	80,264
Abaca Face Mask (Medium - Large) 50%	6,720	165.38	1,111,354	92,612
Total	**13,440**		**2,074,532**	

Projected Financial Statement

Table 6 shows the sales budget for each of the products for the next three successful operating years. Reflected are the total sales by adding all the total revenue values of the products.

Table 6. Projected Sales for the Year 2021-2022

DAKILA
Sales Budget

ABACA FACE MASK (XS-SMALL) Year	**2021**	**2022**	**2023**
Number of units sold/services rendered	3,360	5,040	6,720
Selling price	130.00	136.50	143.33
Total sales revenue	436,800	687,960	963,144
ABACA FACE MASK (MEDIUM - LARGE) Year	**2021**	**2022**	**2023**
Number of units sold/services rendered	3,360	5,040	6,720
Selling price	150.00	157.50	165.38
Total sales revenue	504,000	793,800	1,111,320
	2021	**2022**	**2023**
ABACA FACE MASK (XS-SMALL)	436,800	687,960	963,144
ABACA FACE MASK (MEDIUM - LARGE)	504,000	793,800	1,111,320
Insert Name of Product/Service	-	-	-
Insert Name of Product/Service	-	-	-
Total sales	**940,800**	**1,481,760**	**2,074,464**

Projected Cash Flow

Table 7 shows the projected cash flow statement of the business for the next operating years. The cash flow statement shows the beginning balance of the firm less the expenses incurred on the operating activities to get the ending cash balance.

Table 7. Projected Cash Flow Statement

DAKILA
Statement of Cash Flows
For the years ending 2021, 2022, and 2023

	2021	2022	2023
Beginning cash balance	29,449	302,219	733,026
Operating Activities			
Net Income	280,646	426,409	579,679
Add: Depreciation	141	141	141
Decrease (Increase) In Accounts Receivable	-	-	-
Decrease (Increase) In Supplies	551	-	-
Decrease (Increase) In Inventory	(17,539)	(10,085)	(11,050)
Decrease (Increase) In Prepayments	-	-	-
Increase (Decrease) in Accounts Payable	-	-	-
Increase (Decrease) in Percentage Tax Payable	7,056	4,057	4,445
Increase (Decrease) in Income Tax Payable	1,915	10,285	12,772
Net Cash Inflow (Outflow) from Operating Activities	272,770	430,808	585,988
Investing Activities	-	-	-
Financing Activities			
Additional Investment by Owner	-	-	-
Withdrawal by the Owner	-	-	-
Net Cash Inflow (Outflow) from Operating Activities	-	-	-
Net Cash Inflow (Outflow)	272,770	430,808	585,988
Ending cash balance	**302,219**	**733,026**	**1,319,014**

Projected Income Statement

Table 8 shows the net income after tax for the next three operating years of Dakila. The figures will be the income of the business for the years of successful operations.

Table 8. Projected Income Statement

DAKILA
Income Statement
For the years ending 2021, 2022, and 2023

	2021	2022	2023
Sales	940,800	1,481,760	2,074,464
Less: Spoilage allowance			
Less: Cost of sales/services/goods sold	(584,640)	(920,808)	(1,289,131)
Gross profit	356,160	560,952	785,333
Less: Operating expenses			
Rent Expense	-	-	-
Utilities Expense	(30,000)	(31,500)	(33,075)
Supplies Expense	(783)	(822)	(863)
Salaries Expense	-	-	-
Selling Expense	(7,200)	(7,824)	(8,448)
Taxes and Licenses Expense	(29,729)	(45,458)	(63,239)
Depreciation Expense	(141)	(141)	(141)
Net income before tax	288,307	475,207	679,567
Income Tax (Graduated Tax Rate)	(7,661)	(48,802)	(99,892)
Net income after tax	**280,646**	**426,405**	**579,675**

Projected Balance Sheet

Table 9 shows the projected balance sheet of the business for the next operating years. Shown are the costs of total assets, liabilities, capital, and schedule of equipment.

Table 8. Projected Balance Sheet

DAKILA
Statement of Financial Position
As of the years ending 2021, 2022, and 2023

	Pre-operating	2021	2022	2023
ASSETS				
CURRENT ASSETS				
Cash	29,449	302,219	733,022	1,319,006
Accounts Receivable	-	-	-	-
Supplies	551	-	-	-
Inventory	-	17,539	27,624	38,674
Prepayments	-	-	-	-
Total Current Assets	30,000	319,758	760,647	1,357,680
NONCURRENT ASSETS				
Equipment	-	-	-	-
Furniture and Fixtures	141	-	(141)	(282)
Vehicles	-	-	-	-
Building	-	-	-	-
Land	-	-	-	-
Total Noncurrent Assets	141	-	(141)	(282)
TOTAL ASSETS	**30,141**	**319,758**	**760,506**	**1,357,398**
LIABILITIES				
Accounts Payable	-	-	-	-
Percentage Tax Payable	-	7,056	11,113	15,558
Income Tax Payable	-	1,915	12,200	24,973
Total Liabilities	-	8,971	23,314	40,531
CAPITAL				
Owner, Capital	30,000	310,646	737,051	1,316,726
TOTAL LIABILITIES AND CAPITAL	**30,000**	**319,617**	**760,365**	**1,357,257**

CONCLUSION

The abaca masks are more costly than synthetic surgical masks, but as any environmentalist knows, the monetary cost isn't the only one to consider: there's also the environmental cost to consider. Despite the higher price of these masks, those concerned about the global plastic catastrophe will hopefully see the value in investing in biodegradable masks.

It is necessary to comprehend how masks can be worn by both youngsters and adults throughout the day. Abaca face masks were found to be highly effective in research investigating the effect of abaca face mask use on SARS-CoV-2 transmission, both for children and adults. According to DOST research, the abaca-made mask absorbed three to five percent (3-5%) of the total volume of water dispensed, the N95 mask absorbed forty-six percent (46%) of the total volume of water dispensed, and the surgical face mask absorbed zero-point seventeen percent (0.17 percent) of the total volume of water dispensed.

We propose that people wear a face mask that fulfils government regulations, or, if governments do not, one that meets the criteria of organizations that provide public-facing services. Such mandates must be complemented by steps to assure mask access, maybe including distribution and rationing methods to avoid discrimination.

It is also critical for health officials to give clear standards for the creation, use, and sanitization or reuse of face masks, as well as to consider their distribution when shortages permit. Clear and actionable recommendations can help boost compliance and get communities closer to the objective of lowering and eventually eliminating COVID-19 spread.

Face masks are a significant technique for decreasing community transmission when used in combination with

rigorous testing, contact tracing, quarantining of everyone who may be infected, hand washing, and physical separation. All these methods can minimize the frequency of infections through their effect. As governments relax their embargoes, it will be critical to keep transmissions low enough to maintain health-care capacity until a vaccine is developed.

Although the Philippines is now beginning to distribute vaccines to its citizens, it is not guaranteed that people will stop wearing face masks to protect themselves from the virus as more people become fully vaccinated, many people are wondering when life will return to normal. For the foreseeable future, face masks and physical distance will be essential. People who have been completely vaccinated, on the other hand, should continue to wear face masks and stay a safe physical distance in public settings.

Dakila will use this to address the consumer's needs for face masks that will assist them in preventing and protecting themselves from the virus, even though a vaccine is available. There are those who want an alternative face mask while still seeking good health and resolving existing medical issues. Because of its sustainability, recyclability, affordable price, and fibers that can help consumers protect themselves from droplets and air contamination, the use of abaca face masks as an alternative face mask can pave the way for people. As a result, an increasing number of people will begin to use an abaca face mask as their primary mask. The proposed venture therefore has the potential to be accepted in the market and recommend generating profit and viable business employing sustainable eco-friendly products for the environment and the society.

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