DURMS
Durham Undergraduate
Research in Music & Science

Listening to Music While Studying: Background Sound and its Relationship to Task Performance

Runqi Wang
Durham University

ABSTRACT

Studies on background music have increased due to the high prevalence of music. However, previous studies have found inconsistent results regarding whether background sound (BGS), such as pop music, affects task performance positively or negatively. Thus, the present study aims to expand on the literature on the differences in effects of BGS on task performance. To do so, participants are recruited through an online experiment. The task performance for mathematics and reading comprehension under different BGS conditions (white noise [WN], instrumental music [INS] and instrumental versions of pop music [PMI]) are measured. The results show that WN and INS lead to higher reading speeds compared to silence due to the arousal level or stochastic resonance (SR) thereof. Additionally, WN is found to have the greatest beneficial effects, regardless of the task types. Our conclusions emphasise that BGS that causes arousal benefits task performance, but only a moderate and consistent arousal level can achieve this.

1. INTRODUCTION

Music is more pervasive today than it was in the past, and it appears in many daily activities and places, such as while driving or working. However, some people may be unaware of the presence of music in these settings if they do not pay attention thereto. This type of music is recognised as background music (BGM), which is defined as any music played while the listener's attention is focused on a task other than listening to the music (Radocy & Boyle, 2012). However, even if the person is not aware of the BGM, music can affect their behaviours and perception in certain ways. For example, in education settings, many students have reported that they prefer the presence of BGM while studying because they believe that listening to music can help them remain motivated to study and prevent them from getting drowsy, which in turn, can lead to increased study performance (Patton et al., 1983). This paper will first describe previous findings on the effects of BGM on task performance.

Several studies have supported this effect of BGM on studying, showing that music produces positive effects on task performance. For example, the reading comprehension of children is enhanced after listening to Mozart, which is also known as the Mozart effect (Rauscher et al., 1993). Aside from completing tasks with better performance after listening to music, listening to music during tasks, that is, when BGM is present, also shows beneficial effects. In Hallam and Price's (1998) study, the mathematics performance of children with emotional and behavioural difficulties was tested. They found that the children's performance improves significantly when BGM is present in the classroom. However, several studies replicating the Mozart effect have failed to find any beneficial effects of the music (Steele et al., 1999). To explain the inconsistent results of the Mozart effect, it has been proposed that the differences in listening conditions and arousal levels may cause varied results for the effects of music (Thompson et al., 2001). Here, arousal refers to physical activation, which BGM can encourage. For example, when participants are in a better mood, experiencing feelings of enjoyment and motivation, their task performance is enhanced. Thompson (2001) measured Profile of Mood States to identify arousal levels and found that participants who listen to Mozart tend to have higher levels of arousal compared to those under the silence condition, which in turn, enhances their task performance. Other studies have supported the arousal hypothesis, such as the study that found that reading speed is enhanced under the fast music condition compared to the slow music condition due to higher arousal levels (Kallinen, 2002). Apart from the different types of music (e.g., differing tempos), the inconsistent results found in studies on BGM can also be explained in terms of the various types of tasks (e.g., reading comprehension and mathematics) (Kämpfe et al., 2011). Although studies investigating the effects of BGM on math tasks are limited, previous studies have found that nonverbal task performance, such as spatial processing, is enhanced and speed is increased in the presence of BGM (Angel et al., 2010). Overall, task performance is enhanced when BGM is present, but the level of beneficial effects depends on the type of music played and tasks to be performed.

On the other hand, some previous research has found that BGM has detrimental effects on task performance. For example, previous research has studied the task performance of reading comprehension in the presence of pop music as BGM (Anderson & Fuller, 2010). The researchers measured reading comprehension test scores and

found that the scores under the BGM condition were lower than those under the condition without music. An explanation for the detrimental effects of lyrical BGM is that it limits cognitive capacity, which is also why competitive tasks negatively impact concentration (Kahneman & Daniel, 1973). Although individuals may focus on a reading comprehension task without being aware of the BGM, the words in the reading task and the lyrics of the music are processed together, competing with additional demands in the brain; thus, task performance decreases when two inputs require processing the same type of information (Bourke, 1996). Considering the results for the effects of BGM on task performance in previous research can be beneficial or detrimental, the effects of different types of BGM on task performance, including instrumental music (INS) and instrumental versions of pop music (PMI) are further investigated in this study. PMI, which does not contain lyrics, is chosen in this study to prevent the inference effects of lyrics and due to the detrimental effects of lyrics on task performance.

Apart from music, whether background noise can enhance task performance has also been discussed. Previous researchers have found that the presence of background noise distracts and negatively affects task performance in some circumstances, for example, when workers experience decreased job performance and concentration due to telephones ringing (Banbury & Berry, 2005). For task performance, previous research has found that exposure to chronic aircraft noise impairs reading comprehension and recognition memory among young children but enhances episodic memory (Stansfeld et al., 2005). This reveals that task performance can be enhanced by specific forms of environmental noise, which is also known as white noise (WN). WN usually refers to a special type of environmental stimulation involving exposure to a continuous auditory signal (Helps et al., 2014). Another study that Helps conducted tested the relationship between different levels of WN and the task performance of individuals with different attentional capacities. In this study, super, normal and sub-attentive children were required to perform executive and non-executive tasks while listening to three levels of WN, and the results showed that WN can enhance the performance of non-executive function tasks among normal and sub-attentive children. These WN effects can be explained by the phenomenon of stochastic resonance (SR), which is the beneficial effects that noise causes (McDonnell & Ward, 2011). SR refers to the addition of noise that allows an input signal that was too weak and could not be detected within a non-linear system to be detected. When the levels of these unpredictable fluctuations in noise increase, the signal-to-noise ratio also increases, but only under a moderate level of noise. In terms of task performance, as the threshold of signal transmission or signal detection is increased when WN is present, people performing these tasks are less likely to become distracted due to the high threshold of detection of environmental distractors; thus, cognitive performance is also enhanced (Helps et al., 2014). However, previous studies have usually investigated the effects of WN among children with attentional problems. Therefore, in this study, the effects of WN on two types of cognitive tasks are tested among young adults with normal attentional capabilities.

Considering the beneficial effects of both BGM and noise, previous studies have also compared task performance between the WN and the BGM condition (Carlson et al., 1997). An example is the study that compared the performance of monkeys on a delayed response task with Mozart's music and WN. The researchers found that while Mozart's piano music has detrimental effects on task performance, WN enhances task performance. In another study that investigated the effects of background sound (BGS) among humans, the researchers measured task performance in verbal memory and spatial memory tasks with BGM, including INS, music with lyrics and WN (Iwanaga & Ito, 2002). The results showed that music with lyrics produces the most distractions under all conditions, regardless of the type of task, and WN causes the least detrimental effects on task performance. To explain this, the researchers suggested that the presence of BGM, especially music with lyrics, affects working memory-related neuron processes, which in turn, leads to a reduction in task performance. Contrarily, WN improves performance by preventing environmental distractions during testing. Therefore, the effects of WN and BGM without lyrics are further investigated in this study.

In the present study, silence, WN, INS and PMI are used as the four different BGS conditions. In terms of task performance, both verbal and nonverbal tasks are used, namely reading comprehension and mathematics, respectively. To test the effects of each BGS condition on task performance, it is hypothesised that (H1) the task performance under the three BGS conditions will be better than that under the silence condition. Moreover, to compare the effects of the different BGS conditions, it is hypothesised that (H2) task performance with WN will be better than that under the other two BGM conditions.

2. METHODS

Participants. A total of 30 participants were recruited for this experiment, including 22 females and eight males. Participants were aged between 18 and 29 years old ($M = 20.97$, $SD = 2.27$). Participants were required to provide full informed consent before starting the experiment.

Design. This study was a quantitative online experiment with a mixed design (both within- and between-subject designs). The independent variable of this study was the type of BGS, while the dependent variable was task performance, the latter of which included the time taken to answer each question (AT) and the rate of correct answers given (CA) for the mathematics and reading comprehension tasks.

Materials. Data were collected through a two-part online experiment (see Appendix A), which took around 30 minutes to complete. The BGS was chosen based on previous research: For the WN condition, the sound of rain was chosen since nature sounds are recognised as a type of WN (Iwanaga & Ito, 2002). The piece was a YouTube video (https://youtu.be/HbVYuPogyP0). For the INS condition, Bach's Brandenburg Concerto No.2 was chosen since it has been characterised as a joyful piece (Kallinen, 2002). The tempo of the Bach extract has been slowed to keep the sound quality approximately the same (66 beats per minute). This piece of extract has also been rated as expressing happiness among 92% of music listeners in previous study (Kallinen, submitted for publication). For the PMI condition, Nur ein Wort by Wir sind Helden was chosen, as this piece has been used to induce positive moods (Lehmann & Seufert, 2017). This song was chosen due to its fast tempo but not disturb participants too much. To prevent the detrimental effects of lyrics, the version used in the study is the karaoke version without lyrics. The mathematics and reading comprehension tasks were taken from the Hong Kong Diploma of Secondary Education Examination's (HKDSE) Mathematics and Reading Comprehension past papers because of the examination's wide applicability across most education levels in the local population. The silence condition was Part One of the questionnaire, while the BGS conditions were Part Two of the questionnaire. Each part contained five mathematics questions of similar difficulties and with similar topics, such as inequality, algebra and geometry. A total of 10 mathematics questions were chosen from the HKDSE 2016 and 2019 papers. For reading comprehension, there were two passages, each with five questions. The total word count for each part was controlled at around 250 words to reduce bias related to the reading time for imbalanced passages. The questions were multiple choice and true/false/not given. The reading passages and questions were taken from the HKDSE 2014 and 2017 papers.

Procedure. Participants accessed the test via the Qualtric link posted on Wechat using their personal devices. Prior to the experiment, participants were asked to ensure that they had a pen, calculator and piece of paper at hand. The information sheet that indicated the study's aims and the consent form were also provided before the experiment started. In Part One, all participants were required to answer the mathematics and reading comprehension questions under the silence condition. In the next section, participants were randomly assigned to the WN, INS or PMI conditions and had to complete two tasks, each with 10 participants. Then, demographic information was requested.

3. RESULTS

Table 1 displays the descriptive statistics for the variables of AT, while Table 2 displays the descriptive statistics for the variables of CA.

Table 1. The Means and Standard Deviations of All Variables for AT (in minutes)

Conditions	**Mean**		**Standard deviation**	
	Mathematics	**Reading**	**Mathematics**	**Reading**
Silence	2.49	0.89	1.30	0.47
WN	2.66	0.62	1.65	0.31
INS	2.56	0.56	1.32	0.08
PMI	3.30	0.84	2.41	0.81

Table 2. The Means and Standard Deviations of All Variables for CA (in percentages)

Conditions	**Mean**		**Standard deviation**	
	Mathematics	**Reading**	**Mathematics**	**Reading**
Silence	0.57	0.85	0.24	0.17
WN	0.54	0.88	0.24	0.14
INS	0.56	0.78	0.27	0.18
PMI	0.34	0.74	0.19	0.25

To test the first hypothesis (H1), paired *t*-tests were conducted between AT and CA under the silence condition and one of the BGS conditions for both the mathematics and reading comprehension tasks. The normality and equality of variance were met.

For the reading comprehension tasks, there was a significant difference in AT between the silence condition and the WN condition ($t(9) = 2.84$, $p < .05$, two-tailed), with AT under the silence condition ($M = 0.89$, $SD = 0.47$, $n = 30$) being significantly higher than those under the WN condition ($M = 0.62$, $SD = 0.31$, $n = 10$), with a large effect size ($d = 0.90$). There was also a significant difference in AT between the silence condition and the INS condition ($t(9) = 2.77$, $p < .05$, two-tailed), with AT under the silence condition ($M = 0.89$, $SD = 0.47$, $n = 30$) being significantly higher than those under the INS condition ($M = 0.56$, $SD = 0.08$, $n = 10$), with a large effect size ($d = 0.88$). Figure 1 displays the descriptive statistics of AT under the silence, WN and INS conditions for the reading comprehension tasks. There was no significant difference found between the PMI and silence conditions, though. No other significant results are found. All results are shown in Table 3.

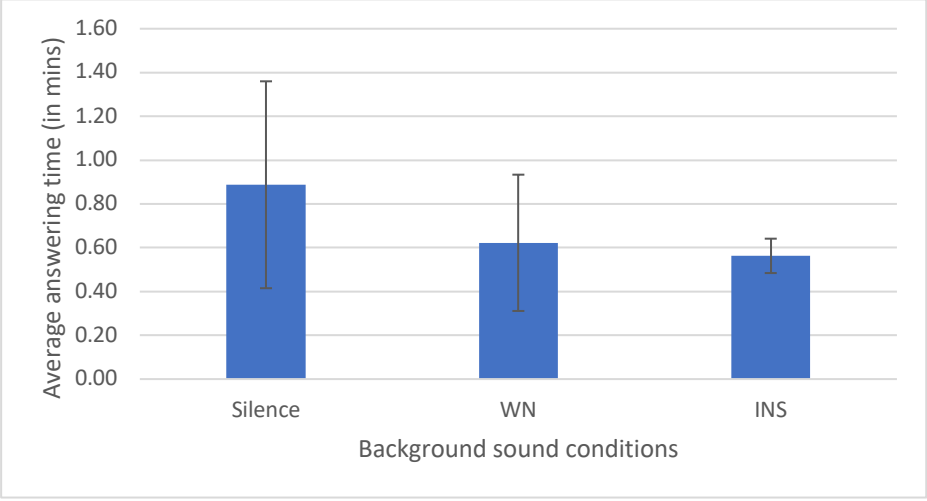

Figure 1. AT for the reading comprehension tasks under the silence, WN and INS conditions

Table 3. The Results of T-tests Between Task Performance under Silence Condition and BGS Condition

BGS condition	CA Reading	CA Math	AT Reading	AT Math
WN	- 0.26	- 0.34	2.84 *	- 0.49
INS	1.15	1.03	2.77 *	- 0.71
PMI	1.05	2.08	1.07	- 1.56

*Note: * p<.05*

To test the second hypothesis (H2), ANOVAs were conducted on AT and CA among the three BGS conditions for both the mathematics and reading comprehension tasks together. Testing for the normality of CA under the three conditions using the Shapiro–Wilks test was assumed due to non-significant results. However, normality could not be assumed for AT, and caution was required in the analysis ($p < .05$). Testing for equality of variance in CA was done using Levene's test, $F(5,54) = 1.33$, $p = .26$. This was non-significant, so equal variance was assumed. However, normality for AT was not assumed, $F(5,54) = 5.40$, $p < .001$.

The results of the ANOVA for CA revealed a main effect of BGS on CA, with a medium effect size ($F(2, 54) = 3.32$, $p < .05$, $\eta^2_p = .11$). Furthermore, post-hoc Tukey tests showed one significant comparison: CA under the WN condition ($M = 0.71$, $SD = 0.26$) was significantly higher than that under the PMI condition ($M = 0.54$, $SD = 0.30$). However, there was no significant difference in CA between the INS condition and the PMI condition ($p = 0.17$) or between the INS condition and the WN condition ($p = 0.80$). The descriptive plot displaying these results is presented in Figure 2.

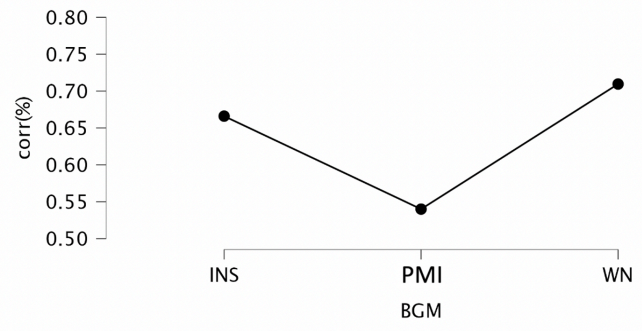

Figure 2. CA under the three BGS conditions

The results of the ANOVA for AT did not reveal any significant main effects, nor did the post-hoc tests among the BGS conditions ($F(2, 54) = 0.81$, $p = .45$, $\eta^2_p = .03$).

4. DISCUSSION

Based on a review of the previous literature, it was hypothesised that task performance under three BGS conditions would be better than under the silence condition, which is partially supported. For BGM, a significant difference between the INS and silence conditions in reading comprehension was found. This result is consistent with the findings of a study that tested reading efficacy with BGM present, which showed that using Bach's Brandenburg Concerto No. 2 as BGS has beneficial effects (Kallinen, 2002). The researchers computed the reading rate and efficiency using reading times and the amount of correct answers given for the true/false questions on reading content and found that these are enhanced under the fast BGM condition compared to the slow BGM condition. The results can be explained in terms of arousal. In Kallinen's study, this piece of instrumental music was proven to be a joyful piece since over 90% of the music listeners reported feeling happiness while listening to the piece. Per the arousal effect, performance is mediated by the different levels of arousal or mood, and increased enjoyment and a better mood enhance performance on various cognitive tasks (Ashby & Isen, 1999). Therefore, the instrumental piece used in this study induced a positive mood and caused increased arousal among the participants, leading to enhanced reading speeds. Moreover, previous research has suggested that listening to BGM while reading increases people's interest in and concentration on the reading materials compared to those who read in silence (Ravaja & Kallinen, 2004). As people become more attentive to the reading content, their reading speed may also decrease. Although arousal benefits task performance, only moderate levels of arousal enhance task performance (Sarason, 1980). If the arousal level is too high or too low, performance on a cognitive task is inhibited. This may explain the non-significant results for task performance between the PMI and silence conditions. Despite the chosen piece for the PMI condition inducing a positive mood, as found in the previous study, the level of arousal may not moderate, which led to inconsistent results for its effect on task performance. These results suggest that the effects of BGM on task performance vary according to the arousal levels that the music causes.

In addition to the effects of BGM on task performance, our results show that AT for the reading tasks were longer under the silence condition compared to under the WN condition. This result is consistent with that of previous research that found that WN benefits task performance in terms of AT (Helps et al., 2014). Helps also found that WN can enhance performance on non-executive function tasks among normal and sub-attentive children. The beneficial effects of WN have been explained in terms of SR in previous research: Signal processing is enhanced by the addition of environmental noise. Although previous research focusing on reading comprehension task performance with WN is limited, the processes for how WN benefits task performance are similar. For example,

in a study that investigated the effects of WN on cognitive performance among ADHD children, it was found that BGS compensates for the hypofunctional dopamine system (Söderlund et al., 2007). In terms of the effects of noise and SR on task performance, the Moderate Brain Arousal (MBA) model explains that there is an association between dopamine function and the effects of WN on task performance (Sikström & Söderlund, 2007). The effects of SR present as a U-shaped curve, indicating that only moderate noise benefits performance, while higher or lower levels of noise lead to detrimental effects thereon. Additionally, the MBA model suggests that optimal cognitive performance peaks at a moderate noise level and depends on dopamine levels (Goldman-Rakic et al., 2000). Considering that dopamine is responsible for suppressing spontaneous activity and enhancing excitability, WN, which comprises continuous noise, increases energy levels, arousal and dopamine levels, thus improving cognitive performance through continuous excitability during tasks (Cohen et al., 2002). Despite individuals with ADHD usually having lower levels of dopamine and, thus, experiencing greater beneficial effects from WN on task performance, the beneficial effects of WN on people with normal attentional capacities have also been shown in this study and can be explained in terms of MBA and SR.

Moreover, it was hypothesised that task performance would be better with WN than under the other two BGM conditions. Our results show significant differences in CA, regardless of the type of task, among the three types of BGS conditions. A previous meta-analysis also found the effects of BGM on task performance to vary according to different types of music (e.g., modes and tempos) and tasks (e.g., reading comprehension and mathematics) (Kämpfe et al., 2011). These varying effects are mediated by different arousal effects. In this study, further post-hoc tests showed a significant difference in CA between the WN and PMI conditions, with CA under the WN condition being significantly higher than that under the PMI condition. Although previous research has explained that music with lyrics has greater detrimental effects on linguistic meaning distraction than WN, our results still suggest that PMI has fewer beneficial effects than WN (Iwanaga & Ito, 2002). Apart from lyrical effects, this difference can also be explained in terms of the Changing State model (Banbury & Berry, 1997). That is, the beneficial effects of BGM and WN on task performance are mediated by arousal levels. However, while exposure to the same type and a continuous level of WN leads to participants adapting to the disturbance and having their arousal states maintained, meaning that they are less likely to become distracted, fluctuations in PMI, such as in volume and tempo, lead to unstable states and, thus, worse task performance compared to under the WN condition (Jones, 1993). This difference is similar to that found in SR, in which only a moderate level has beneficial effects, while higher or lower levels have negative effects. Overall, WN has the greatest beneficial effects on task performance in terms of CA, between two tasks studied in this study.

As with any research, our study had several limitations. First, the volume of the BGS in this study was not controlled, which may have caused some non-significant results. For example, previous research has shown that 70dB is the optimum level for WN, while higher or lower volumes may have detrimental effects on task performance (Moss, 2004). Therefore, future research should control for the volume of the BGS to obtain less biased results.

Second, the effects of BGS on task performance are also mediated by task complexity (Furnham & Allass, 1999). It was suggested that the more complex and demanding the task, the stronger the detrimental effects of the BGS. Although the beneficial effects of BGS on task performance in nonverbal and logical tasks have been found in several studies, no significant results for mathematics tasks were found in this study, which may have been due to the tasks' complexity. When task complexity surpasses the individuals' abilities, their task performance is more likely to be negatively affected by BGS. Despite the tasks used in this study being widely applied across most education levels, the varied abilities of the participants would still have caused biased results. Therefore, future research should group participants based on their abilities and then measure the effects of BGS on their task performance.

The present research contributes to the knowledge on how different types of BGS affect task performance. Although some results were not significant, it was still revealed that WN and INS have beneficial effects on task performance compared to the silence condition, respectively. Among the different types of BGS, WN has the greatest beneficial effects because it is more stable, especially compared to PMI. However, this study did not control for the volume of the BGS and the difficulty of the tasks, which may have caused biased results. Thus, future research should consider reducing these biases and further investigate the differences in the beneficial effects of the types of BGS on verbal and nonverbal tasks.

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Appendix A – Experiment questions

Silence condition:

In this section, you are going to answer a set of Maths and Reading Comprehension questions. Please type your answers in the text boxes provided, and make sure you will not be interrupted in the next couple of minutes and do not engage with other activities because the responded time is recorded.
There are 5 questions in each Maths and Reading Comprehension part. Please answer as accurate as you can. You may need a scratch paper and a calculator for Maths part.

1. If $6x - 7y = 40 = 2x + 11y$, then y =

_____

2. The least integer satisfying the compound inequality $-2(x - 5) + 5 < 21$ or $(3x - 5)/7 > 1$ is

_____

3. A sum of $65000 is deposited at an interest rate of 7% per annum for 8 years, compounded quarterly. Find the amount correct to the nearest dollar:

_____

4. In the figure, the 1st pattern consists of 6 dots. For any positive integer n, the (n+1)th pattern is formed by adding 4 dots to the nth. Find the number of dots in the 9th pattern:

_____

5. In the figure, ABC and ADE are straight lines. It is given that AB = BD and BC = CD. If ĐCDE = 66°, then ĐACD =,

_____

Passage 1

In 1996, I wrote an article arguing that the recycling process as we carried it out was wasteful. I presented plenty of evidence that recycling was costly and ineffectual, but its defenders said that it was unfair to rush to judgment. Noting that the modern recycling movement had really just begun a few years earlier, they predicted it would flourish as the industry matured and the public learned how to recycle properly.
So, what's happened since then? While it's true that the recycling message has reached more people than ever, when it comes to the bottom line, both economically and environmentally, not much has changed at all.
Despite decades of initiatives, it's still typically more expensive for local governments to
recycle household waste than to send it to a landfill. Most recycled materials are exported, and the prices for these materials have plummeted because of lower oil prices and reduced demand for them overseas. The slump has forced some recycling companies to shut plants and cancel plans for new technologies.

Decide whether the following statements True (T), False (F) or Not Given (NG)?

	T	F	NG
1) The writer is more optimistic about the recycling industry than he was in 1996.	○	○	○
2) Supporters of recycling are disappointed that the industry hasn't matured.	○	○	○
3) Sending household waste to landfills is typically more costly than recycling it.	○	○	○
4) The business of some recycling companies has suffered.	○	○	○

Passage 2

They probably assume, for instance, that recycling plastic must be helping the planet. They've been encouraged by the Environmental Protection Agency (E.P.A.), which assures the public that this results in fewer carbon emissions being released into the atmosphere. But how much difference does it make? Here's some perspective: To offset the carbon impact of one passenger's round-trip flight between New York and London, you'd have to recycle roughly 40,000 plastic bottles, assuming you fly economy. If you sit in business- or first-class, it could be more like 100,000.

The writer uses the example of flying to show that recycling …

- ○ A. Has some benefits
- ○ B. Is not very effective
- ○ C. Is as bad for the environment as flying
- ○ D. Can be effective, depending on which class of airfare

BGS condition:

In this section, you are going to listen a piece of background sound, and answer a set of Maths and Reading Comprehension questions. The sound will be played automatically. Please type your answers in the text boxes provided, and make sure you will not be interrupted in the next couple of minutes and do not engage with other activities because the responded time is recorded.
Please ignore the youtube video, just listen to the background sound.

There are 5 questions in both Maths and Reading Comprehension parts. Please answer as accurate as you can. You may need a scratch paper and a calculator for Maths part.

1. A sum of $100 000 is deposited at an interest rate of 2% per annum for 3 years, compounded monthly. Find the interest correct to the nearest dollar

_____

2. Let a , b and c be non-zero numbers. If 3a = 4b and a : c = 2 : 5, then (a + 3b) / (b + 3c) =

_____

3. In the figure, ABCD is a rhombus. ABE and BCF are straight lines such that BE = EF. If ĐBEF = 56°, then ĐBDC =

_____

4. Two numbers are randomly drawn at the same from seven cards numbered 1 , 1 , 1 , 2 , 2 , 3 and 4 respectively. Find the probability that the sum of the numbers drawn is 5.

_____

5. The least integer satisfying the compound inequality $5 - 4x < 9$ or $(2x - 3)/7 > 1$ is

_____

Passage 1

People have searched for an effective way of improving the good fortune in their lives for many centuries. Lucky charms, such as keeping a rabbit's foot, have been found in virtually all civilizations throughout recorded history. The pagan ritual of "knocking on wood' was designed to elicit the help of benign and powerful tree gods. Superstition represents people's attempts to control their destiny by warding off bad luck while enhancing the good.

Decide whether the following statements True (T), False (F) or Not Given (NG)?

	T	F	NG
1) Superstitions have existed for hundreds of years.	○	○	○
2) Superstitions are only found in some countries.	○	○	○
3) Superstitions are becoming less popular.	○	○	○

Passage 2

"Oh look!" Rachel shouted, the door."
"There's a robot at Winston Sinclair hoped it wasn't one of those sales robots. They were nearly impossible to get rid of. He picked up Rachel and raised the viewing screen she had used. The robot was one metre tall, grey, squat, plain-looking.
"Robot, what do you want?"
It had a cheap synthesized voice. “Winston Sinclair, born February 18, 2000?"
"Yeah…..”
"Worked at CommaTech from 2023 to 2026?"
"Honey, don't buy anything," his wife Elizabeth called from the living room.
“Pardon, Winston Sinclair, I am not here to sell you something. I am not here to buy something. Winston Sinclair, sir, I am here to apologize."
Winston sat on the couch with Elizabeth and Rachel while the robot explained.
"I contain an apology for Winston Sinclair from Karl Anderson."
“Karl Anderson? I haven't heard that name in, gosh, probably ten years."
Rachel pulled at his shirt sleeve. "Daddy, who's Karl?”
"We worked together at CommaTech, then he got a great job at Future Industries. I applied to work there, but they never called back.”
The robot beeped. “Pardon, Winston Sinclair. Will you hear the apology?”

Decide whether the following statements True (T), False (F) or Not Given (NG)?

	T	F	NG
1) At first glance, the robot does not appear to be very impressive.	○	○	○
2) Karl and Winston both wanted to work at Future Industries.	○	○	○