

THE EFFECT OF VOCAL AND INSTRUMENTAL BACKGROUND MUSIC ON PRIMARY SCHOOL PUPILS' VERBAL MEMORY USING A SENTENCE RECALL TASK.

Anna O'Hare
Graduated 2011, Psychology
anna.o-hare@ucdconnect.ie

ABSTRACT

The aim of this study was to determine whether there is a difference between vocal and instrumental music on verbal memory and to examine the listening habits of students while they study, using a questionnaire. Participants consisted of 108 children from five primary school classes of 4th class from three different schools in Dublin. Students ranged in age from 8-10 years ($M = 9.37$, $S.D. = .620$) with a female to male ratio of approximately 7:3. Group one consisted of 26 children who experienced the silent control condition, group two of 41 children who listened to instrumental music and group three of 41 children who listened to vocal music. All groups performed a sentence recall memory test from Pressley's (1987) study and completed a music listening habits questionnaire. No significant difference was found between memory performance of children listening to music overall in comparison with the silent control group. However when the music condition was split into vocal and instrumental groups a significant difference was found. Post hoc tests showed the instrumental group had significantly higher scores than silent group and the vocal group had significantly worse performance than the instrumental group. Findings were discussed in relation to possible practical applications in school, at home and at work, methodological weaknesses and future research in the area.

INTRODUCTION

"Just as there can be no music without learning, no education is complete without music"- (Anderson, Henke, McLaughlin, Ripp & Tuffs, 2000). Research throughout the years has demonstrated that playing music in the background can have positive effects on memory recall, particularly spatial memory recall and this is known as the Mozart effect (Rauscher,

Shaw & Ky, 1993; as cited in Yao, Sun, Poggio, Liu, Zhong & Huang, 2010). The present study examined the difference between the effects of vocal and instrumental music on verbal memory task performance using a new method- a sentence recall task. It also considered music listening habits of students in a range of contexts. Hallam, Price and Katsarou (2002) stated that little is known about the extent to which children are exposed to music in their everyday lives or its effects on their mental functions and the present study strived to add to this knowledge base.

The effect of background music on behaviour, emotions, moods and mental tasks has been noted throughout history. Memory is the general process of encoding, storing and retrieving information (Martin, Carlson & Buskist, 2007). Several studies have shown that listening to Mozart's music may induce an improvement on the performance of certain kinds of mental tasks. The Mozart effect was first reported by Rauscher, Shaw and Ky (1993; as cited in Yao et al 2010). Experiments have since been replicated. Don Campbell claimed that listening to Mozart may produce other beneficial effects on mental function (Campbell, 1997). Music is said to have an effect on memory (Simmons-Stern, Budson & Ally, 2010).

Not all research has found positive effects. Salame and Baddeley (1989) found that music disrupted short term memory performance in the immediate serial recall of sequences of nine visually presented digits; this is known as working memory. Working memory allows us to manipulate material in short term memory, remembering material whilst engaging in a different, related task (Martin, Carlson & Buskist, 2007). It is susceptible to disruption by irrelevant speech- the irrelevant speech effect. Irrelevant speech impairs the immediate serial recall of visually presented material (Gisselgard, Petersson & Ingvar, 2004).

There may be differences in the effect of music on verbal working memory depending on the type of music being played, particularly the difference between effects of vocal and instrumental music (Newman, Hunt & Rhodes, 1966; as cited in Furnham & Bradley, 1999). Salame and Baddeley (1989) found vocal music to be more disruptive in the serial recall of the visually presented digits. Hallam, Price and Katsarou (2002) looked at the effect of music on a memory task in children. The memory task required pupils to remember a word from a sentence with recall cued by the remainder of the sentence being presented. There were a total of ten sentences taken from a study by Pressley, McDaniel, Turnure, Wood and

Ahmad (1987). Music that was calming led to better performance on the memory task compared to no music.

In addition, there have been studies that look at the impact of background music on behaviour in a range of environments including situations where individuals listen to music while studying (Kotsopoulou & Hallam, 2004). Kotsopoulou (1977; as cited in Kotsopoulou & Hallam, 2004) developed a questionnaire to explore students' listening habits including statements relating to listening to music while studying. The study looked at the differences of listening habits across different cultures to examine cross cultural differences but there been no research done on Irish students and therefore identifies a gap in the research.

The aim of this study was to examine the effect of vocal and instrumental background music on primary school pupil's performance on a sentence memory recall task. The present study used a method from the Hallam et al (2002) study which originally came from the study by Pressley et al (1987) and strived to see if there was a difference between vocal and instrumental music and their impact on verbal memory. This method has not been previously used to study this difference. Hallam et al (2002) reported that more systematic work needed to be undertaken.

As the majority of research done has found that vocal music has a detrimental effect on verbal recall, but instrumental music has a positive effect (Salame & Baddeley, 1989) the hypotheses were:

Hypothesis One: Performance in a memory test is better when listening to instrumental music compared to listening with vocal music or with no music.

Hypothesis Two: Performance is worse when listening to vocal music in comparison with no music and instrumental music.

Another aim was to examine listening habits of students while studying, using the questionnaire used by Kotsopoulou and Hallam (2004). These were compared to results found by Kotsopoulou and Hallam to see if habits had changed and what Irish children's habits in three different schools were. Most research has focused on the use of music while students undertake tasks and has not reflected the ways that people listen to music while doing homework, therefore the present study explored this and the differences in students' use of music in their studying.

METHOD

The manipulated variable in this study is the music condition and has three levels; instrumental music, vocal music and no music (the control group). The dependent variable is memory recall.

A pilot study was carried out, piloting the measures with four children with parental consent. Children ranged in age from 7 to 10 years and were balanced for gender. Changes were made in the verbal instructions given to the children as there were queries regarding the questionnaire; whether it referred to listening habits in school or at home, and whether they could include other activities during which they listen to music. This was made clearer in the instructions.

The target sample was five primary school classes of 4th class from three different schools in Dublin. Students ranged in age from 8-10 years ($M=9.37$, $S.D = 0.62$). The first class sample where the condition was listening to instrumental music, the second where in one class the condition was listening to vocal music and another class was the silent condition. The silent condition was a control group. The third school had the independent variable of vocal music. The size of the study population was 108 pupils. Only two of the schools were mixed males and females and there were more females than males in both of these classes. Therefore gender was not balanced as females outnumbered males approximately 7:3, with 18 males and 23 females in the instrumental condition, 11 males and 30 females in the vocal condition and 26 females in the silent group.

The following materials were used: (i) Memory test from Pressley's (1987) study consisting of a booklet for each child of ten stimulus sentence cards, and a booklet of ten cued recall cards. (see Appendix D); (ii) Questionnaire (Section Three from study by Kotspoulou and Hallam (2004) relating to listening to music while studying. (see Appendix C); (iii) Music of instrumental and vocal version of "Summertime" by Ella Fitzgerald; (iv) Folders to collect the tests and questionnaires.

PROCEDURE

Letters were sent to principals of the three different schools seeking permission to carry out the research in their schools. This permission was granted. Ethics Approval was sought from the UCD Undergraduate Research Ethics Committee- School of Psychology. Information sheets (see Appendix A) and parental permission forms (see Appendix B) were sent to

the schools and were given to children to bring home to their parents to be signed and returned if they decided to take part. Communication was made via phone between the researcher and principals and a suitable day for testing was decided upon. The study was explained to the students and they were reminded that the experiment was voluntary. Children who did not bring back parent consent forms were instructed to read a book. Participants were instructed not to write their names but to write their gender and age. Each student was provided with the booklet of ten stimulus sentences and instructed as follows:

“The purpose of this study is to find out how well you can learn sentences while instrumental music/vocal music/no music is played in the background. Please read the following sentences and try to memorise them. I will read each sentence out loud and you will have 10 seconds to read each one. Every ten seconds I will tell you to turn the page to the next sentence. Do you all understand? Are there any questions?”

Every ten seconds the children were asked to turn to the next page. When the sentences had been read, the booklets were collected by the researcher and the questionnaire (Section Three) including statements relating to listening to music while studying was given out. The questionnaire was explained and they were told to put an “X” in the box if it applied to them and only to answer the questions on the sheet. After students had completed this, the cued-recall booklets were given out and the children instructed:

“You have to fill in the gaps with the missing word in every sentence. Spelling mistakes do not matter. You will have 10 seconds to write the missing word in each sentence. Every 10 seconds I will tell you to turn the page. Do you understand? Are there any questions?”

The background music was played throughout with volume controlled. Each piece was repeated until completion of the study. Any questions children had after testing were answered and they were all thanked for their time and participation.

RESULTS

The background music was played throughout with volume controlled. Each piece was repeated until completion of the study. Any questions children had after testing were answered and they were all thanked for their time and participation. A 3 x 1 One-way ANOVA found that there

was a statistically significant main effect of group on the variable age $df(2)$, $F = 21.119$; $p < 0.001$. Post Hoc tests showed the silent group were significantly younger than the other groups – instrumental group ($p = .022$) and the vocal group ($p = .001$). The vocal group were significantly younger than the instrumental group ($p < .001$). Therefore age needs to be taken into account as a confounding variable.

In order to determine whether music overall made a difference to memory scores, a two-tailed t-test was carried out. No significant differences on memory scores of the silent group ($N = 26$) and the music group i.e. instrumental and vocal groups combined ($N = 82$) was found overall. ($df(106)$ $t = .255$, $p > 0.001$). (See means and standard deviations in table 3.2).

A one-way ANOVA comparison of total scores across groups found a significant main effect of group $df(2)$, $F = 14.485$, $p < .001$. Post Hoc tests carried out showed that the instrumental group performed significantly better than the two other groups ($p < .001$) and the silent and vocal groups were not significantly different from each other ($p = .250$).

The groups differed significantly in the extent to which they listened to music whilst studying, revising, writing, reading, solving maths problems, thinking and studying their favourite subject. The only activities where groups did not differ was studying their least favourite subject and learning a foreign language. Given these differences between groups it is important to consider the probability of familiarity with listening to music as a possible confounding variable.

Males and females performance on the memory test were compared over all- males ($M = 7.30$, $S.D = 2.87$) females ($M = 6.19$, $S.D = 2.37$). A comparison t-test was carried out and no significance was found $df(106)$ $t = 1.548$; $p = .125$.

A 2×2 ANOVA was performed to determine if there was a main effect of gender or an interaction between gender and music condition. Vocal and instrumental groups were compared across boys and girls and a significant difference between the instrumental and vocal groups was found. It was not possible to include the silent group in this analysis as they were all females. There was a main effect of group, as previously identified ($F(1) = 31.33$; $p < .001$). However, there was no main effect of gender ($F(1) = 0.06$; $p = .811$), nor an interaction between gender and

condition ($F(1) = .03$; $p = .866$). Thus, it is unlikely that the results from the main section are attributable to gender.

Pearson's correlation parametric tests were carried out to see if there is a relationship between age and memory performance for the whole sample there was a strong trend towards age being significantly correlated with memory score, $R = .187$, $p = .053$. Therefore, age was entered as a covariate in the ANOVA to establish whether the main effect of group was still significant. There was a reduction in the level of significance after covarying for age, but there was still a main effect of group ($F = 15.060$; $p < .001$).

There were no significant differences in memory recall scores between those who listened to music during each activity and those who did not overall. Therefore it is unlikely that group differences in familiarity with listening to music can account for the overall main findings.

DISCUSSION

The aim of this study was to examine the effect of vocal and instrumental background music on primary school pupils' performance on a sentence memory recall task and to examine the listening habits of students while they study using a questionnaire. This study demonstrates that type of background music can have distinctive effects on memory task performance. In looking at the silent group versus the music group as a whole, no significant difference was found over all. However, when the music group was separated into vocal and instrumental groups, the findings suggest that the effects of music on memory task performance depend on the type of music, whether instrumental or vocal. The first hypothesis stating that performance in a memory test will be better when listening to instrumental music in comparison to with vocal music or no music was supported. Instrumental music was seen to have a positive effect on memory recall as children remembered the ten missing words in cued recall better than in the other two groups. The second hypothesis stating performance will be better when listening to no music than listening to vocal music was not supported as the difference was not significant. However in comparison with instrumental music the vocal group performed significantly worse on the task.

Overall, the findings from results of the questionnaires indicate that students reported listening to music while writing the most, followed by

thinking and reading. The least reported activities undertaken while listening to music were revising and solving maths problems. No relationship was found between results on the memory recall test and questionnaire results; answers of participants who reported listening to music during the activities on the questionnaire did not impact on results of the memory task. This meant that familiarity with listening to music while studying did not affect results on the sentence memory recall task.

Potentially confounding variables- age and gender were examined to see if they made a difference to results. There was a statistically significant difference between ages over all as they all differed from each other as tested by an ANOVA, but when correlation was carried out; there was no significant correlation between age and memory total score. No significant difference for gender was found when a comparison t-test was carried out, and therefore there was no main effect for gender. This led to the conclusion that age and gender cannot be used as an explanation for support of the two main hypotheses of this study.

Results for hypothesis 1 which stated that performance in a memory test would be better when listening to instrumental music in comparison with vocal music or no music was consistent with the majority of findings in this area; that memory recall will be better when listening to instrumental music in comparison to vocal or no music. The results supported the findings of such researchers as O' Donnell (1999) who found that learning potential can be increased a minimum of five times using music, and Dr. Belanger (1978; as cited in Anderson et al, 2000) who found that background instrumental music creates the optimal learning environment for memorising information. The results therefore, support the concept of the Mozart effect.

Anderson et al (2000) found instrumental music to be a promoter of higher memory recall in classroom work rather than studying in silence or listening to vocal music. Salame and Baddeley (1989) found vocal music to be more disruptive than instrumental music in serial recall of digits. Results for hypothesis two partially supported this finding, as memory recall when listening to vocal music was worse than when listening to instrumental music but not when listening to no music. These results supported the findings of Crawford and Strapp (1994) who found that vocal music disturbed performance more than no music in an object-number test which involve associative learning and memory. This has

been said to be because of irrelevant speech influencing the phonological loop system which is responsible for retention of material in working memory (Martin-Loeches, Schweinberger & Sommer, 1997).

There were strengths to this study relating to the procedure and measures. In other studies volume of music was sometimes not controlled for, therefore volume was held constant throughout the conditions by keeping the speakers at the same level for each condition and by not placing anyone very near the speakers. The nature of the memory task was a strength of the study as participants were told that they were going to have to try and remember the ten sentences. This makes it comparable to a learning task or piece of work in school, which means the study has practical applications (discussed later). Although the test used was comparable to an academic task in school, the particular test was novel and the children had no previous exposure to it. The research reported here provides a contribution to the understanding of the ways music might affect memory and various aspects and forms of studying. Hallam, Price and Katsarou (2002) said that much more systematic work needed to be undertaken taking into account the nature of the music being played, and this was done in the present study.

The silent group were all girls; therefore gender was not matched across groups. A methodological limitation was only recording children's ages in years. If ages were recorded by years and months, then perhaps the groups would have been better matched. A possible methodological limitation of the questionnaire on listening habits is that it is based on self-report and not corroborated by another source. Experimentally manipulated conditions were strived for in this experiment but some children did talk which may have disrupted concentration (Tomasi, Caparelli, Chang & Ernst, 2005). An important issue to consider is that some members of the classes were not of Irish nationality and English was not their first language. This was not recorded in the demographic characteristics. The majority of participants from the instrumental condition were non-nationals which could have impacted on their understanding. However, given that they outperformed the other groups, it is unlikely that there was an extremely adverse effect on performance of poor English.

For children's memory both inside and outside of school, parents should be made aware of the effects that music can have, particularly

where they might be negative; e.g. children listening to vocal pop music while doing homework. Teachers should be made aware of positive effects, which may not only increase enhance learning in the classroom but also have other positive effects benefiting education such as enhancing musical knowledge. The findings could be relevant to all people who work in a communal area, i.e. open-plan offices listening to music. Management should be made aware of research on this topic as it could be taken into consideration in devising strategies for optimising workforce output.

Further research should look at characteristics of the individual, listening environment, and recent life events that the students may have experienced- Hallam, Price and Katsarou (2002) referred to these further needed areas of study in their research. More attention should be paid to other distraction effects as well as whether the music is instrumental or vocal. These might include the participant's individual liking of the musical piece being played, familiarity with the particular song, the speed of the music and the tonality of the piece (either atonal which is known to make people feel uneasy, major which tends to evoke positive emotions, or minor which has a tendency to evoke more negative, sad feelings). Due to the self-report nature of the questionnaire based on self-perceptions, further research should be carried out to explore whether the children's perceptions of their use of music in the academic tasks is accurately reported.

REFERENCES

- Anderson. S., Henke. J., McLaughlin. M., Ripp. M., Tuffs. P., (2000). Using Background Music to Enhance Memory and Improve Learning. Master's Action Research Project. Saint Xavier University.
- Campbell, Don (1997). *The Mozart Effect: Tapping the Power of Music to Heal the Body, Strengthen the Mind, and Unlock the Creative Spirit*. HarperCollins.
- Chou. P. (2008). *The Effects of Background Music on Reading Performance*. VDM Verlag.
- Crawford. H., Strapp. C. (1994). Effects of vocal and instrumental music on visuospatial and verbal performance as moderated by studying preference and personality. *Personality and Individual Differences* 16(2), 237-245.
- Furnham. A., Bradley. A., (1999). Music while you work: the differential distraction of background music on the cognitive test performance of introverts and extraverts. *Applied Cognitive Psychology* 11(5) 445-455.

Gisselgard, J., Petersson, K., Ingvar, M., (2004). The irrelevant speech effect and working memory load. *Neuroimage* 22(3): 1107-1112.

Hallam, S., Price, J., Katsarou, G., (2002). "The Effects of Background Music on Primary School Pupil's Task Performance", *Educational Studies*, 28: 2, 111-122.

Kotsopoulou, A., Hallam, S., (2004). Cross –cultural Differences in Listening to Music while Studying. *Proceedings of the 8th International Conference of Music Perception & Cognition*.

Leung, M., Fung, L., (2005). Enhancement of classroom facilities of primary schools and its impact on learning behaviours of students. *Facilities*, 23(13), 585-592.

Martin, G., Carlson, N., Buskist, W., (2007). *Psychology*. Pearson Education Limited.

Martin-Loeches, M., Schweinberger, S., Sommer, W. (1997). The phonological loop model of working memory: An ERP study of irrelevant speech and phonological similarity effects. *Memory & Cognition*, 25(4), 471-483.

O' Donnell, L. (April, 1999). Music and the Brain. Retrieved October 2, 2010, from <http://www.cerebromente.org.br/n15/mente/musica.html>

PASW Statistics (2009). PASW Statistics 18.0 for Windows/Apple Mac. SPSS Inc., Chicago

Pressley, M. (1987). Generation and Precision of Elaboration: Effects on Intentional and Incidental Learning. *Journal of Experimental Psychology: Learning, Memory and Cognition* 13(2), 291-300.

Salame, P., Baddeley, A., (1989). Effects of Background Music on Phonological Short-term Memory. *The Quarterly Journal of Experimental Psychology*, 41 (1), 107-122.

Simmons-Stern, N., Budson, A., Ally, B. (2010). Music as a memory enhancer in patients with Alzheimer's disease. *Neuropsychologia* 48, 3164-3167.

Tomasi, D., Caparelli, E., Chang, L., Ernst, T. (2005). fMRI- Acoustic noise alters brain activation during working memory tasks. *Neuroimage* 27(2) 377-386.

Yao, Y., Sun, R., Poggio, T., Liu, J., Zhong, N., Huang, J., (2010). *Brain Informatics: International Conference*. Springer: Canada.