The Effects of Multiple Types of Auditory Distraction on Mathematical Problem Solving

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Introduction

• Purpose of Our Study: Sought to understand the relationship between distraction and problem solving

• Looked at the influence of different forms of distractions on problem solving

• Why Study it?
  • It gives researchers an understanding of the role distraction has relating to problem solving and whether its influence is negative or positive
Relevant Research

• Cool et al. (1994) - studied effect of distraction (in the form of T.V.s and Radios) on students ability to complete math and reading assignments
  • - Found that individuals complete fewer math problems when distracted by either a radio or television

• Perham et al. (2016) - studied effect of disruption, in the form of background speech, on participants ability to solve mental addition problems
  • - Found that individuals perform the worst when the distraction material is relevant yet incongruent

• Alder & Benbunan-Fich (2015): studied effects that different types of multitasking had on performance
  • - Found that individuals perform poorly when a task is perceived as difficult and there are distractions present

• Speier et al. (2003) - studied influence of interruptions on different types of decision making tasks
  • Found that interruptions facilitate performance on simple tasks and inhibit performance on complex Tasks
Introduction

• This particular study focuses on effect of auditory distractions on Mathematical Problem solving

• **Hypothesis:** The presence of distraction will decrease the number of problems solved correctly and increase the number of mistakes

• And Participants will solve less problems and make more mistakes during the math distraction condition
  • Perham et al. (2016)
Methods - Participants

• 18 +

• 18 – 32 y.o. (M = 21.04, SD = 2.62)

• Convenience Sample of 48 Total Participants

• 26 Male (54.2%)

• 22 Female (45.8%)
Methods – Materials and Apparatus

• Math Sheet with 119 One-digit Addition Problems
• List of Questions for Experimental Conditions
• Writing Utensil
• Cell Phone for Stopwatch
Methods – Procedure

• Potential participants asked if they would participate

• Participants told that they would have 90 seconds to complete as many math problems as they could in any order

• Choose from three presented math sheets in order to assign condition

• Given sheet facedown and a writing utensil

• Asked if ready then instructed to start
Methods - Procedure

• Control Condition
  • Participants given full 90 seconds uninterrupted

• Trivia Condition
  • Participants asked 4 questions
  • 30s - How many planets are in the solar system?
  • 45s - Who is on the 50-dollar bill?
  • 60s - What is the capital of Hawaii?
  • 75s - What is the currency of Europe?
Methods - Procedure

• Math Condition
  • Participants asked 4 questions
  • 30s - What is 36 – 14?
  • 45s - What is 68 – 24?
  • 60s - What is 53 – 15?
  • 75s - What is 85 – 9?

• Trial Completion
  • Experimenter filled in supplemental info (age, gender, condition, Etc.)
  • Participant informed of nature of study
Results

• One Independent Variable Multi-Level Between Subjects Design
• Data collected by student researchers was pooled and organized into a Microsoft Excel file and imported into SPSS for analysis.
• Data analysis consisted of two Analysis of Variance tests (ANOVA) to reflect the two dependent variables, number of questions answered correctly and number of questions answered incorrectly.
ANOVA 1
Questions Answered Correctly

• $F(2, 45) = 14.62, \ p = .000$

Conditions:
0 = control (silence)
1 = distraction involving random trivia questions
2 = distraction involving mathematical questions

$M = 67.42 \quad SD = 13.24$
$M = 49.07 \quad SD = 8.63$
$M = 47.36 \quad SD = 13.39$
ANOVA 1
Questions Answered Correctly
Post Hoc Comparisons

• The mean difference between conditions 0 and 1 is significant.
• The mean difference between conditions 0 and 2 is significant.
• These findings suggest that distraction in either of these forms is enough to significantly decrease the number of questions answered correctly, but type of distraction does not seem to be relevant.

<table>
<thead>
<tr>
<th>Condition A</th>
<th>Condition B</th>
<th>Mean Difference (A-B)</th>
<th>SE</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>18.35</td>
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</tbody>
</table>

Note. The mean difference was significant at the .05 level.

Conditions:
0 = control (silence)
1 = distraction involving random trivia questions
2 = distraction involving mathematical questions
ANOVA 2
Questions Answered Incorrectly

- $F(2, 45) = 4.03, p = .037$

Conditions:
0 = control (silence)
1 = distraction involving random trivia questions
2 = distraction involving mathematical questions

- $M = .79, SD = 1.03$
- $M = 1.13, SD = .99$
- $M = 1.79, SD = 1.19$
ANOVA 2
Questions Answered Incorrectly
Post Hoc Comparisons

• The mean difference between conditions 0 and 2 is significant.
• These findings suggest that only distraction in the form of mathematical questions had an impact on the number of mistakes made.

<table>
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</tbody>
</table>

Note. The mean difference was significant at the .05 level.

Conditions:
0 = control (silence)
1 = distraction involving random trivia questions
2 = distraction involving mathematical questions
Discussion - Findings

• Hypothesis: The presence of distraction will decrease the number of problems solved correctly and increase the number of problems solved incorrectly. Specifically, the distraction by math problems condition will make more mistakes and solve less problems correctly than the other conditions.

• Findings suggest that the type of distraction is not necessarily important for the number of problems solved correctly.

• However, the difference in the number of problems solved incorrectly was significant only in the distraction by math problems condition.

• Overall, our results mostly provide support for our original hypothesis.
Discussion- Previous Literature

• The results from our study also offer support for some of the other literature on this topic

• Cool et al. (1994) found that individuals complete fewer math problems when distracted by either a radio or television
  • We found support for this in both of our auditory distraction conditions

• Perham et al. (2016) found that individuals perform the worst when the distraction material is relevant yet incongruent
  • The distraction by math problems condition was the condition participants performed the poorest in

• Alder & Benbunan-Fich (2015) found that individuals perform poorly when a task is perceived as difficult and there are distractions present
  • For many, math is a daunting task and adding distractions makes it more overwhelming and causes poorer performance
Discussion - Limitations

- A major limitation present is that participants were drawn from a sample of convenience
  - Majority of the participants were in their early 20’s ($M = 21.04$, $SD = 2.62$)
  - We can not assume that the results generalize to the general population
- A second limitation is that the environment that the participants were tested in was not controlled for
  - There may have been other distractions present in the environment (e.g. noise levels, crowd size, etc.)
  - It is possible that this limitation could have skewed our results
Discussion - Future Research & Implications

• Future research should look to manipulate the type of math problem presented as a distraction
  • Perham et al. (2016) - mental arithmetic
  • This would help researchers further understand the relationship between distraction and problem solving

• Teachers only have so many hours in a day to teach 20+ students so this type of research can help them determine how to best arrange the classroom environment to promote a more productive work space

• This same logic can also be applied within the workplace; if less distractions are present, employees will perform more efficiently

