

Environmental Context and Student Performance

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Two sets of data were collected to assess the effects of having different environmental contexts for teaching and testing. There was a negligible effect on test performance when teaching and test rooms were minimally different. There was, however, a significant decrement in test performance when teaching and test rooms were substantially different. Implications for further study and applications in educational situations were noted.

Deux séries de données ont été collectées en vue d'évaluer les effets de contextes environnementaux différents sur l'enseignement et les examens. L'effet sur les résultats des examens était négligeable lorsque les salles de cours et d'examens étaient très peu différentes. Les résultats des examens étaient toutefois considérablement moins bons lorsque les salles de cours et d'examens étaient nettement différentes. On note les implications possibles de ces observations dans des recherches portant sur d'autres contextes pédagogiques.

Could environmental variations affect the reliability and validity of tests? Teachers may, for instance, divide a class into two groups, one to be tested in the original learning environment, the other in an unfamiliar room. Some students may take standardized tests, as during provincial examinations in high schools, or final examinations at university in gymnasias or other rooms accommodating large numbers under more controlled circumstances than in traditional classrooms. In such situations, a change in ambience may in fact affect students' performances, and students in the unfamiliar environment may perform less well.

A number of psychological studies have examined this issue. Carr (1925) concluded that "an experience can be recalled most readily in those environmental situations with which it has the most direct, the strongest and most numerous associations" (p. 251). We might surmise that subject matter studied primarily in a given classroom has numerous associations with that classroom. Carr's ideas lead to the prediction that testing in rooms where teaching and learning take place should cause better performance than testing in unfamiliar rooms.

Abernathy (1940) conducted one of the earliest tests of this hypothesis.

Her classroom data agreed with outcomes expected on the basis of laboratory studies, and she concluded that constancy of environment leads to efficiency in recall. Her data showed performance decreased when pupils were tested by a substitute teacher or in an unfamiliar room, and that the disadvantage was greatest when both teacher and room were changed for testing. Abernathy also suggested that change of environment would affect superior students less than inferior students.

More recently, Smith and his colleagues (Smith, 1979; Smith, 1984; Smith, Glenberg, & Bjork, 1978) reported on laboratory experiments dealing with the effect of environment on test performance. These studies generally support Abernathy's claims. Furthermore, Smith found that students tested in a novel environment could partially overcome its effects by forming a mental image of the room in which the original learning had taken place. However, when Fernandez and Glenberg (1985) attempted to replicate Smith's findings, they found that environment may variably affect test performance. They did not suggest that environment has no effect, only that the effect is not always easy to produce.

Effects of environment in educational settings have been interpreted in relation to context-dependent memory.

Context-dependent memory is influenced by, for example, emotional and drug-induced states (state-dependent memory), as well as by physical features of the general environment and specific characteristics of the material to be remembered. If one were told to complete the sentence, "As I walked through the orchard, I picked up a red ____" on the basis of semantic context, one would probably answer "apple." Alternatively, if the sentence were, "As I walked through the pool hall, I picked up a red ____," one might answer "pool ball."

In their review of trends in the field of human learning and memory, Horton and Mills (1984) noted that the contextualist view is "alive and well" at both the empirical and theoretical levels. They gave special attention to the notion of encoding specificity (Tulving & Thomson, 1973), which emphasizes the importance of the encoding context at the time of retrieval. Tulving and his associates have applied the concept of encoding specificity to the processing of semantic information, and suggest that specific encoding operations are performed on what is perceived. Everything we perceive has some context, and both the target stimulus and its context are stored in memory. Encoding determines what is stored, and what is stored determines which retrieval cues will work. Retrieval of the context can stimulate retrieval of the target stimulus and vice versa.

In this paper, we present two sets of data collected in educational situations to assess the effects of environmental context on test performance. Both sets involve university students whose classroom for a given course was consid-

ered crowded. For an examination, the professor divided each class into two groups. One group was tested where the class regularly met for instruction, the other was tested in a different room. In each case the tests contained free recall questions (short essay) and cued recall questions (e.g., fill-in-the-blank) but not recognition (multiple choice) questions.

METHOD

Study 1

The subjects were 53 students enrolled in a fourth-year statistics course for psychologists. They included first-year graduate students ($N=18$) and fourth-year undergraduates ($N=35$) who all had taken at least one prerequisite statistics course. Performance levels were relatively homogeneous; more than half the students eventually received first-class marks. Half were randomly assigned to be tested in the regular classroom and half in a different room. Four students assigned to the different room did not follow instructions and were actually tested in the regular classroom. This left 30 in the regular classroom and 23 in the different room. All students received the same examination at the same hour. This was the first examination given in the course.

The two testing conditions varied in several respects. The rooms were in different buildings. Although the rooms were similar in size, they varied in paint colour, lighting, and floor plan. In the novel room students had individual desks with small writing surfaces, and the regular classroom had large tables with 2 to 3 students per table. Finally, the course instructor supervised testing in the regular classroom, while an assistant supervised testing in the different room.

Study 2

The students in Study 2 were 52 undergraduates enrolled in the course prerequisite to the course discussed in Study 1 above. The type of subject matter thus was similar to that in Study 1. In Study 2, the test was the third monthly examination in the course. On each earlier test, approximately half of the students had been tested in their regular classroom and half in a different room—which was not the same one used in the present study.

The previous test scores were used to form two matched groups. Subjects were ranked from high to low, based on total prior scores. From the top pair of students, one was randomly assigned to the group being tested in the regular classroom and the other to the novel test room. Similarly, for each successive pair of students, one was assigned to each testing condition. This

insured that the two groups would have similar pretest performance levels and an equal number of high-, medium-, and low-scoring students.

Unlike the test rooms in Study 1, the two in this study were similar. They were located in the same building, had the same paint colour and floor plan, and had similar student desks. The major differences between the two environments were that the different test room was about 30 percent larger, and that it was oriented 180 degrees opposite to the regular classroom (i.e., instructor in the east end with windows on the north instead of in the west end with windows on the south). As in Study 1, the course instructor supervised testing in the regular classroom while an assistant supervised testing in the novel classroom.

RESULTS

In Study 1, the mean percent correct showed that the group tested in the regular classroom ($\bar{X}=77.1$, $s=12.8$) performed significantly better than the group tested in the other classroom ($\bar{X}=71.9$, $s=12.4$), $t(51)=7.30$, $p<.001$. This outcome appears to replicate findings on context-dependent memory discussed by Smith (1984), Abernathy (1940) and others.

In Study 2, the percent correct scores were treated by analysis of variance and showed that students with high prior standing ($\bar{X}=78.9$, $s=8.8$) still performed better than those with low prior standing ($\bar{X}=58.8$, $s=15.9$), $F(1,24)=22.04$, $p<.0001$. There was no significant difference between the scores of those tested in their regular classroom ($\bar{X}=69.1$, $s=15.2$) and those tested in the other room ($\bar{X}=68.6$, $s=17.8$), $F<1$. The interaction between these factors was also not significant, $F<1$, indicating that the negligible effect of test room was virtually the same for students with high prior standing and those with low prior standing.

DISCUSSION

Study 1 replicated prior findings regarding the effects of environment, and Study 2 illustrates some limitations of environmental effects. In Study 1, students were tested in rooms that differed in several features. Students in the novel test room performed less well than those tested in the regular classroom. By comparison, in Study 2 the second test room was similar to the regular classroom and there was no significant difference between the two groups' performance. Although the data from Study 1 support the claim of Smith (1984) and others, the data from Study 2 are consistent with findings by Fernandez and Glenberg (1985) and by Saufleay, Otaka, and Bavaresco (1985), that the effect of context is ephemeral and does not occur in all cases.

These findings imply that testing may not be standardized if some students are tested in a familiar environment while others are tested in an unfamiliar environment. Research suggests that any of several differences between the teaching and test environment can contribute to the context effect; examples of such differences include the person supervising the test, the size and location of the test room, and prior experience in being tested.

A problem for educators is that most investigations of the study-test context effect have been in laboratory settings with university students. Although the present data also came from university students, they have the advantage of having been collected under ecologically valid conditions. Since we observed the context effect under "real-life" conditions, further study along these lines seems in order.

One variable worthy of more attention is the type of test being taken. Laboratory research (e.g., Smith et al., 1978) indicates a novel environment is more likely to impair performance if the test items are essay or fill-in-the-blank. Such questions provide minimal cues. On the other hand, performance on tests consisting of multiple-choice items is less affected by context. This seems reasonable because multiple-choice alternatives provide additional cues. Smith et al. (1978) also suggest that students tested in a novel room can minimize the effect of context by forming images of the room in which they originally studied the material.

The effects of type of test and of compensatory strategies have been assessed only in limited laboratory research where test periods were close together in time; further applied research is needed. Such research may eventually show why performance decreases in some trials of the study-test context effect, but not in others. We might also learn how better to protect students from bias when they are assessed.

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Um die Auswirkungen verschiedener Umweltkontexte auf Unterrichts—und Prüfungssituation zu bewerten, wurden zweierlei Daten gesammelt. Wenn Unterrichts—und Prüfungsräume sich minimal unterschieden, gab es eine kaum nennenswerte Auswirkung auf die Prüfungsleistung. Ein bemerkenswertes Absinken der Prüfungsleistung ergab sich jedoch, als Unterrichts—und Prüfungsräume bedeutend anders waren. Auswirkungen auf weitere Untersuchungen und Anwendungen in erziehungswissenschaftlichen Situationen wurden aufgeführt.

Dos grupos de datos fueron adquiridos para evaluar los efectos de contextos ambientales diferentes en la enseñanza y los exámenes. Hubo un efecto deseñable en el rendimiento cuando la enseñanza y las salas de exámenes eran mínimamente diferentes. Sin embargo, hubo una disminución significativa en el rendimiento cuando la enseñanza y las salas de exámenes eran substancialmente diferentes. Se consideraron implicaciones para estudios futuros y para aplicaciones en situaciones pedagógicas.

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