

Do Higher Levels of Arousal Predict Better Learning?

An Investigation of Learning and Physiological Responses

Tiffany R. Lee, Joan M. Davis, Nancy Vye, John D. Bransford, University of Washington, Seattle,
Email: tlee13@u.washington.edu, nancyvye@u.washington.edu, bransj@u.washington.edu

Abstract: The ability to connect new information to relevant, previously acquired knowledge can facilitate comprehension and memory. This study shows that the addition of person knowledge, or knowledge organized around familiar people, in the design of learning materials has the potential to improve learning while decreasing the amount of effort and attention exerted by the learner; this is measured through skin conductance levels as a physiological correlate of attention. Findings provide explanatory evidence for why people-focused methodologies, such as video cases or written case studies, contribute to longer-term benefits and improved learning.

Introduction and Purpose of Study

It is well known that the ability to connect new information to relevant, previously acquired knowledge can facilitate comprehension and memory (e.g. Bransford & Johnson, 1972; Dooling & Lachman, 1971). Much of this work has involved connections of new knowledge to previously acquired scripts or schemas such as “washing clothes” (e.g. Bransford & Johnson, 1972). The ability to elaborate and generate self-explanations has also been shown to improve learning and understanding of new information (e.g., Chi, de Leeuw, Chiu, & LaVancher, 1994). In other words, knowledge organized around people may have a special status, much like spatial organization and script-based organization have special mnemonic effects. We use the term “person knowledge” to refer to this phenomenon. The ubiquity of person knowledge may have a unique neural basis; alternatively, it may be a type of knowledge where many forces conspire to make it special (e.g., people are one of the primary sources of early learning, people are motivating, etc). The basis of person knowledge and whether it can be dissociated from other forms of learning are important questions to explore (Lin & Bransford, 2005).

We have research findings that show that there are advantages to organizing information around people. In a prior study (Davis, Lee, Vye, Bransford, & Schwartz, 2006), we found that a conversation was more interesting and easier to imagine when was about familiar people than when the same passage involved unfamiliar people. Learners also remembered more of the main ideas from the familiar people conversation.

This study is a replication of the Davis et al (2006) study with an added physiological measure of participants' skin conductance levels (SCL) to investigate why information organized around familiar people is better remembered. Skin conductance measures are widely accepted as a measure of physiological arousal (Dawson, Schell, & Filion, 2000). Prior research indicates that skin conductance levels tend to decrease over time as a participant engages in an activity. However, engaging stimuli can increase participants' arousal or attention and is associated with a sustained level of skin conductance during the activity or task (Mutz & Reeves, 2005). We predict that participants who learn information organized around familiar people will show a more sustained level of skin conductance than those who learn information organized around unfamiliar people, indicating a greater level of arousal or interest in the material.

Methods

Participants. Twenty-five (25) students from the teacher education program at a northwest university volunteered to participate in the study. This group of participants was selected because they had previously participated in a classroom activity that would be part of this study, although unknown to them at the time. The participants' average age was 28.0 years; 21 participants were female and 4 participants were male.

Procedure. Participants were randomly assigned to one of two groups (1) General Person Knowledge group (GPK) and (2) Personal Person Knowledge group (PPK). Participants in both groups individually completed four tasks: (1) reading of materials while skin conductance levels were recorded, (2) second reading of materials while skin conductance levels were recorded, (3) comprehension and interest ratings of the previously read conversation, and (4) recall of information from the previously read conversation. The reading materials were presented on a computer screen, and the participants were given three minutes to read each conversation. Participants' skin conductance levels (SCL) were recorded as a correlate of attention and arousal using a BioGraph Infiniti 3.1 from Thought Technology Ltd.

For the first reading, both groups read a written conversation between five unknown persons who have just successfully worked together to solve a problem and are discussing whether to work together in the future (see appendix 1). In this conversation, each person was marked only by his or her names (e.g., Len, James, Helen, etc.). Participants were given three minutes to read the conversation. During the reading of the

conversation, measures of participants' skin conductance were collected.

For the second reading, participants in the GPK group were asked to read the exact same conversation with the same five unfamiliar people. Alternately, the PPK group was reminded of five people whom they all "knew" (characters from a short movie they had seen a few weeks prior as part of an unrelated course activity). After this reminder, the PPK participants were asked to read the same conversation a second time, but with one difference: the initial names of unfamiliar people had been replaced with names of the familiar people (i.e., Len became Larry, James became Jasper, etc). Again, measures of participants' skin conductance were collected during this task.

At the completion of the two readings, the physiological equipment was removed from the participant's hand. Participants then rated the two conversations in terms of relative interest and comprehensibility. For interest, participants rated the conversation on a 5-point scale: much less interesting, somewhat less interesting, equally interesting, somewhat more interesting, or much more interesting. The same scale was used for comprehensibility.

The last task required participants to recall information from the previously read conversation. They were reminded of the three themes from the conversation: (1) celebration and thanks, (2) ideas for improvement, and (3) reasons for adding outreach through an internship program and were asked to provide as much detail about the conversation as possible, including who was involved in particular ideas or activities.

Results and Discussion

The results from this study confirm the value of person knowledge in the design of learning materials, as shown in previous studies on person knowledge. The written conversation organized around familiar people received significantly higher ratings for interest and comprehension by the Personal Person Knowledge group in comparison to the General Person Knowledge group, $F(1, 18) = 3.879, p < 0.05$; $F(1, 18) = 22.224, p < 0.001$. In addition, the PPK group recalled significantly more overall details and correctly paired details from the previously read conversations, $F(1, 18) = 4.588, p < 0.05$; $F(1, 18) = 3.758, p < 0.05$.

The physiological component of this study, measures of participants' skin conductance levels, provides novel insights about why participants' in the PPK group perform better on the recall than the GPK group. Contrary to our initial hypothesis, analyses of the skin conductance measure reveal that participants in the PPK group showed a *decrease* in skin conductance levels while the levels of the GPK group *increased*. We expected the PPK group remain higher, indicating more sustained attention and interest, and thus explaining why this group might perform better on the recall task. Interestingly, this group had decreasing levels of skin conductance, yet performed better on the recall task.

One interpretation is that the PPK group found the material less interesting than the GPK group during the second reading. However, this does not align the interest ratings data which indicate that participants in the PPK group generally rate the information as more interesting.

A more plausible possibility is that the PPK group had an easier time reading the second conversation because they had some familiarity with the persons involved. Therefore, they did not need to exert as much effort to comprehend the text and remember information. This implies that participants in the PPK group who read the text about familiar people were able to attend to the information less while reading and still achieve better results compared to the GPK group, despite the extra effort exerted by that group. The finding that participants in the PPK group rated the second conversation as more comprehensible is consistent with the imagery data.

If the second interpretation of the findings is correct -- that people in the PPK group exerted less effort but performed better because of the familiarity of persons in the text -- these unexpected findings have interesting implications for education. It appears that information is better remembered when organized around familiar people, and it also requires less cognitive effort for this learning to occur. These findings provide support for the benefits of designing instruction that takes advantage of person knowledge.

References

- Bransford, J.D., & Johnson, M.K. (1972). Contextual prerequisites for understanding: Some investigations of comprehension and recall. *Journal of Verbal Learning and Verbal Behavior*, 11, 717-726.
- Chi, M.T.H., de Leeuw, N., Chiu, M., & LaVancher, C. (1994). Eliciting self-explanations improves understanding. *Cognitive Science*, 18, 439-477.
- Dooling, D.J., & Lachman, R. (1971). Effects of comprehension on retention of prose. *Journal of Experimental Psychology*, 88(2), 216-222.
- Davis, J., Lee, T. R., Vye, N., Bransford, J.D., & Schwartz, D.L. (2006). The role of people knowledge in learning narrative and domain content. In S. Barab, K. Hay & D. Hickey (Eds.), *Proceedings of the Seventh International Conference of the Learning Sciences (ICLS)*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Dawson, M.E., Schell, A.M., & Fillion, D.L. (2000). The electrodermal system. In J.T. Cacioppo, L.G.

- Tassinari, & G.G. Berntson (Eds.), *Handbook of psychophysiology*, 2nd ed (pp. 200-223). New York: Cambridge University Press.
- Lin, X., & Bransford, J. (2005). *People knowledge: A useful ingredient for bridging cultural differences between teachers and students*. Paper presented at the meeting of the American Educational Research Association, Montreal, Canada.
- Mutz, D.C., & Reeves, B. (2005). The new videomalaise: Effects of televised incivility on political trust. *American Political Science Review*, 99(1), 1-15.