

## Adult Curiosity Dimensionality

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**Abstract:** The need to discern the dimensions of curiosity is compelling as researchers strive to understand better the developmental implications of learning. Six hundred and two participants completed 10 curiosity scales. Scores were factored using Principal Components Analysis and a varimax solution. A three-factor interpretation of the curiosity construct was supported.

Curiosity, which stands at the juncture of motivation and cognition (Loewenstein, 1994), is increasingly being regarded as one of the important facets of human behavior. The experiences gained through information seeking (curiosity) and exploratory behavior allow for normal patterns of cognitive development (Giambra, Camp, & Grodsky, 1992). Curiosity is an important element in the development of a psychologically healthy person, and the desire to satisfy one's curiosity is one of the important factors motivating people to acquire new knowledge (Maslow, 1970). Curiosity and the exploratory behavior it elicits are vitally important because they help individuals flexibly adapt to changing environmental conditions and improve their problem solving skills (Voss & Keller, 1983). Moreover, the "disposition to be curious" is one of the seven essential contributors to good thinking (Perkins, Jay, & Tishman, 1993). Indeed, distinguished psychologists (Berlyne, 1960; Csikszentmihalyi, 1996; Fowler, 1965; Lepper & Hodell, 1989; Piaget, 1952; Vygotsky, 1986; & Woolfolk, 2001) all have viewed curiosity as one of the primary motivators and directors of the creation of knowledge, i.e., learning.

### Definitional and Conceptual Issues

Two major research approaches have proven to be fertile ground for providing insights into the curiosity construct: a) taking a global research approach viewing curiosity as either an enduring personality trait or a temporary motivational state (Boyle, 1983, 1989); and (b) considering curiosity on a more fundamental level, where measures of curiosity are factor-analyzed and parsimonious factors identified to clarify the precise nature of the psychological construct. The latter approach was deemed most appropriate for the purposes of this study.

#### *Dimensionality*

Over the past several decades, researchers have developed numerous definitions and descriptions, together with a wide range of terms, to describe the psychological construct of curiosity. As they have done so, some have used the terms "sensation seeking," "exploration," "novelty seeking," "play," or "interest" interchangeably, while others have considered each of these to be quite separate constructs (Krietler & Krietler, 1994). Specifically, Olson and Camp (1984) considered curiosity to be unidimensional; Berlyne (1954; 1960), Day (1971), Langevin (1971), Ainley (1987), and Spielberg and Starr (1994) argued that curiosity has two dimensions. Others including Byman (1993) and Krietler and Krietler (1994) contended that curiosity is best thought of as having three or even five dimensions.

Regardless of the research approach they preferred, all of the scholars mentioned above favored investigating the information-seeking aspect of curiosity, which they characterized as a state of arousal induced by a lack of information, which motivates people to create knowledge. However, information seeking may not be the only kind of curiosity relevant to learning (Day, 1971; Spielberg & Starr, 1994; Zuckerman, 1979, 1994). Zuckerman (1979) for instance,

posited another kind of curiosity, sensation seeking (conceptually similar to Day's [1971] "diversive" curiosity), which he defined as "the need for varied, novel, and complex sensations and experiences and the willingness to take physical and social risks for the sake of such experience" (p. 10). Thus, the motivation for this type of curiosity is not necessarily for information and knowledge acquisition. Bjork-Akesson (1990) extended Zuckerman's sensation-seeking personality construct to mean a broad preference for arousal and discovered that this type of curiosity increases the likelihood that individuals will have positive attitudes toward challenges, complexity in school settings, and working in small groups.

#### *Factor-Analytic Investigations of Curiosity*

Langevin (1976) re-examined his 1971 curiosity research conducted with 269 12-year-old Canadian children by studying what he considered to be an adult sample: 53 teacher education students and 30 hospitalized individuals. Although this second protocol is questionable with respect to both his subjects and his methodologies (e.g., inadequate sample size for factor-analytic work [Kline, 1993]), Langevin concluded that the two dimensions he previously found in his factor-analytic study of children's curiosity (i.e. "breadth-of-interest" and "depth-of-interest") were simply artifacts of the measurement forms he used.

Ainley (1987) followed Langevin's research, correcting the problems associated with his study by using a much larger sample (Australian; primarily female). She also used self-report measurement instruments and what she considered to be "adults," i.e., college students with a median age of 20 years. Ainley concluded that Langevin's (1971) early work was supportable and that curiosity consists of two distinct dimensions or factors, breadth- and depth-of-interest. (Giambra et al., [1992] also supported using Ainley's two-factor interpretation of curiosity for adults of any age because the two-factor interpretation facilitated clearer understanding when comparing different age groups.) Yet Byman (1993), taking a structural modeling approach, re-analyzed Ainley's (1987) original data and argued for a third and perhaps a fourth curiosity factor. Clearly, more research is needed to clarify the dimensionality of the curiosity construct. This new information could lead to new measure development and subsequent research examining curiosity's possible role in social, emotional, physical, cognitive, and spiritual development across the lifespan and for teaching and learning application.

The purpose of this study was to further investigate and clarify the dimensions of the curiosity construct. The hypotheses that guided this study were: (a) curiosity is a multidimensional construct, and (b) curiosity has four or fewer dimensions.

### **Method**

#### *Participants*

The participants in this study were 255 males and 347 females, 17 to 64 years old ( $N = 602$ ), from education classes at a large eastern US university ( $n = 369$ ) and four businesses ( $n = 233$ ). The overall sample was 85% Caucasian, 11% African American, 3% Asian, and 1% "other."

#### *Instrumentation*

Four well-studied instruments with 10 subscales were selected from the curiosity measures reported in the literature for use in this study. The selected measures were in order: the Melbourne Curiosity Inventory (MCI; Naylor, 1981), the State-Trait Personality Inventory (STPI; Spielberger et al., 1980), the Sensation Seeking Scale (SSS; Zuckerman, 1979), and the Novelty Experiencing Scale (NES; Pearson, 1970). All of these measures are self-report, pencil-and-paper questionnaires, as recommended by Ainley (1987). Results of the study revealed that internal consistencies ranged between .69 and .88 for all but one of the subscales, the Experience

Seeking subscale of the Sensation Seeking Scale, which had an internal consistency of .49 (not investigated further in this study).

The Melbourne Curiosity Inventory has one 20-question state and one 20-question trait curiosity subscale, while the State-Trait Personality Inventory has 10-question state and trait curiosity subscales (the State-Trait Personality Inventory also has 10-question anger and anxiety subscales not used in this research); both the Melbourne Curiosity Inventory and State-Trait Personality Inventory are considered measures of information seeking, the cognitive type of curiosity. The Novelty Experiencing Scale, with its four 20-question subscales, includes two subscales representing cognitive curiosity (Internal and External Cognitive) and two subscales representing the sensation seeking type of curiosity (Internal and External Sensation). With sensation seeking, novel sensations and changing experiences are sought out more often merely for the experience. The Sensation Seeking Scale consists of four 10-question subscales measuring four dimensions of sensation seeking: Thrill-and-Adventure Seeking, Disinhibition, Boredom Susceptibility, and Experience Seeking. Thus, each of the measures is essentially a trait measure of curiosity.

#### *Procedure*

The selected curiosity measures, along with a demographic survey, were administered to all 369 participants in their respective education classes. The other 233 test batteries were administered at their places of work. Participation was voluntary, with complete anonymity assured. The purpose of the study was first explained; the measures were then distributed, with an average administration time of 35 minutes per individual. To reduce the risk of an order effect, the order of the instruments was altered at each site. Preliminary analysis of the curiosity scores from the four businesses indicated that the strength and direction of correlations were consistent by business, suggesting that there was not an order effect. Further evidence that there was not an order effect was ascertained by examining the patterns of correlations between four of the education classes as well. Again, the strength and direction of correlations between the research variables were consistent by education group.

#### *Data Analysis*

Sample size was determined by factor-analytic convention, which stipulates that there should be at least five, and preferably 10, cases per variable and a minimum sample size of 200 (Kline, 1993). As there were 10 variables and 602 participants in this study, this convention was comfortably followed. The two samples were analyzed for systematic differences (2 x 10 MANOVA) between the two groups (college students and working adults) by each of the curiosity variables. There was a significant multivariate main effect  $F(10, 590) = 10.79, p < .001, \eta^2 = .16$ . ANOVAs with Scheffé post hoc analyses revealed that two of the variables were significantly different between the two groups (internal cognitive and boredom susceptibility), thus the results should be interpreted cautiously. A factor analysis by group and by gender produced very similar patterns of coefficients, with almost identical amounts of variance being explained. With these results in mind, Tabachnick and Fidell (1989) recommend combining the groups to increase sample size and statistical power. Thus, the student and adult worker groups were combined, but again the results should be interpreted appropriately.

### **Results**

As endorsed by Olson and Camp (1984) and Ainley (1987), the scores from each curiosity subscale were entered as variables in an exploratory factor analysis. After an internal reliability analysis (Cronbach's alpha) was performed and the correlation matrix for factorability was subsequently examined, a Principal Components Analysis (PCA) was rendered on all

variable scores of the 10 subscales, based on the matrix of their Pearson product-moment correlations. Using the Kaiser Criterion, where all factors with eigenvalues greater than one are retained and usually rotated for the final solution, only three factors were extracted. Recognizing that the Kaiser Criterion may over- or underestimate the number of factors (Kline, 1993), a scree test was used as a second criterion, and it indicated the need to retain three factors as well. As a general rule, after a PCA, an acceptable number of eigenvalues greater than one should be the number of variables divided by three and the number of variables divided by five (Tabachnick & Fidell, 1989). Because there were 10 variables, two to four factors were predicted, and there were three. As was mentioned previously, the scree test called for the interpretation of three.

The eigenvalues of the three identified factors were 2.91, 2.32, and 1.14, accounting for 23.5 percent, 23.3 percent, and 16.8 percent of the total variance, respectively. Consequently, 63.6 percent of the total variance was explained by the three extracted factors.

Once the set of three factors was extracted from the correlation matrix by a PCA, they were rotated (varimax) to increase the interpretability of the factor solution. The varimax rotation is considered to be “THE orthogonal procedure” (Gorsuch, 1983, p. 204) as it maximizes the variance of the squared coefficients within factors, i.e., after extraction, high coefficients become higher and low coefficients become lower to facilitate the factor interpretation.

Examination of the three-factor solution yielded interesting results (see Table 1). With the three-factor solution, the internal cognitive, external cognitive, academic curiosity, MCI and STPI scale scores loaded on Factor 1 (Cognitive Curiosity; Malone [1981]). On Factor 2 (Physical Thrill-Seeking), the external sensation and thrill-and-adventure scale scores loaded significantly. Both the disinhibition and boredom susceptibility scale scores loaded on Factor 3 (Social Thrill Seeking). Similar to Ainley (1987), one scale score (internal sensation) loaded ambiguously on both Factors 1 and 2 and was deleted from further analysis.

Table 1.

*Principal Component Analysis with Varimax Rotation of 10 Trait Curiosity Scale Scores*

Curiosity Scale	Cognitive Curiosity	Physical Thrill-Seeking	Social Thrill-Seeking
Internal cognitive	<b>.65</b>	.23	-.39
External cognitive	<b>.63</b>	.27	-.27
STPI curiosity	<b>.77</b>	-.03	.16
Melbourne curiosity	<b>.83</b>	-.02	.06
Internal sensation	.38	.34	.16
External sensation	.03	<b>.85</b>	.17
Thrill-and-adventure	.02	<b>.80</b>	.19
Disinhibition	-.14	.28	<b>.67</b>
Boredom susceptibility	-.01	.04	<b>.83</b>

*Note.*  $N = 602$ . Emboldened coefficients are salient and thus interpretable ( $\geq .40$ ; Tabachnick & Fidell, 1989).

### Discussion

Supporting the first hypothesis, there was no evidence of a single, general curiosity factor as was first predicted by Berlyne (1966), the “Father of Curiosity,” and later partially supported by Langevin (1976) and Olson and Camp (1984). Supporting the second hypothesis, the factor

structure of the test scores demonstrates that the curiosity construct has fewer than five dimensions. Demonstrating the robustness of the findings, the three-factor interpretation was appropriate also when splitting the data by gender and by group.

The findings of this exploratory study suggest that a three-factor interpretation of curiosity provides an appropriate classification system for curiosity, explaining 63.6% of the variance. The cognitive curiosity factor has a clear link to learning, as demonstrated in the literature. Piaget (1952) suggests that development and learning is linked to both the cognitive and sensory types of curiosity, but he does not specify to what degree. More research is needed to determine how and why the sensory or physical and social thrill seeking types of curiosity possibly interact with cognitive curiosity to stimulate development and learning. A possible next step would be to conduct confirmatory research to further clarify curiosity's precise structure. This confirmatory information could serve as a vital guide to future educational and psychological research and practice by providing a clear point of departure for exploring the role and meaningfulness of curiosity as a motivator and promoter of learning.

### References

- Ainley, M. D. (1987). The factor structure of curiosity measures: Breadth and depth of interest curiosity styles. *Australian Journal of Psychology*, 39, 53-59.
- Berlyne, D. E. (1954). A theory of human curiosity. *British Journal of Psychology*, 45, 180-191.
- Berlyne, D. E. (1960). *Conflict, arousal, and curiosity*. New York: McGraw-Hill.
- Boyle, G. J. (1983). Critical review of state-trait curiosity test development. *Motivation and Emotion*, 7, 377-397.
- Boyle, G. J. (1989). Breadth-depth of state-trait curiosity? A factor analysis of state-trait curiosity and state anxiety scales. *Personality and Individual Differences*, 10, 175-183.
- Byman, R. (1993). From two-dimensional to three-dimensional curiosity: A reanalysis of depth-breadth-factor model. *Australian Journal of Psychology*, 45, 155-160.
- Cohen, J., & Cohen, P. (1983). *Applied regression/correlation analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.
- Csikszentmihalyi, M. (1996). *Creativity: Flow and the psychology of discovery and invention*. New York: HarperCollins.
- Day, H. I. (1971). The measurement of specific curiosity. In H. I. Day, D. E. Berlyne, & D. E. Hunt (Eds.), *Intrinsic motivation*. (pp. 77-97). Toronto: Holt, Rinehart and Winston of Canada, Ltd.
- Fowler, H., Jr. (1965). *Curiosity and exploratory behavior*. New York: Macmillan.
- Giambra, L. M., Camp, C. J., & Grodsky, A. (1992). Curiosity and stimulation seeking across the adult life span. *Psychology and Aging*, 7, 150-157.
- Gorsuch, R. L. (1983). *Factor analysis*. (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.
- Gross, D. W. (1975). Curiosity in context. *Childhood Education*, 51, 242-243.
- Kline, P. (1993). *The handbook of psychological testing*. London: Routledge.
- Krietler, S., & Krietler, H. (1994). Motivational and cognitive determinants of exploration. In H. Keller, K. Schneider, and B. Henderson (Eds.), *Curiosity and exploration* (pp. 259-284). Berlin: Springer-Verlag.
- Langevin, R. (1971). Is curiosity a unitary construct? *Canadian Journal of Psychology*, 25, 360-374.
- Langevin, R. (1976). Construct validity of sensation seeking and curiosity measures of normal and psychotic subjects. *Canadian Journal of Behavioural Science*, 8, 251-262.

- Lepper, M. R., & Hodell, M. (1989). Intrinsic motivation in the classroom. In C. Ames, & R. Ames (Eds.), *Research on motivation in education* (Vol. 3), (pp. 73-105). San Diego: Academic Press.
- Loewenstein, G. (1994). The psychology of curiosity: A review and reinterpretation. *Psychological Bulletin*, *116*(1), 75-98.
- Malone, T. W. (1981). Toward a theory of intrinsically motivating instruction. *Cognitive Science*, *4*, 333-369.
- Naylor, F. D. (1981). A state-trait curiosity inventory. *Australian Psychologist*, *16*, 172-183.
- Nunnally, J. C., & Bernstein, I. H. *Psychometric theory*. (3rd ed.). New York: McGraw-Hill.
- Olson, K. R., & Camp, C. J. (1984). Factor analysis of curiosity measures in adults. *Psychological Reports*, *54*, 71-74.
- Pearson, P. H. (1970). Relationships between global and specific measures of novelty seeking. *Journal of Consulting and Clinical Psychology*, *34*, 199-204.
- Perkins, D. N., Jay, E., & Tishman, S. (1993). Beyond abilities. *Merrill-Palmer Quarterly*, *39*, 1-21.
- Piaget, J. (1952). *The language and thought of a child*. New York: World.
- Reeve, J. (1996). *Motivating Others*. Boston: Allyn & Bacon.
- Spielberger, C. D., Barker, L., Russell, S., Silva De Cane, R., Westberry, L., Knight, K., & Marks, E. (1980). Unpublished manuscript, *Preliminary manual for the state-trait personality inventory (STPI)*. University of South Florida.
- Spielberger, C. D., & Starr, L. M. (1994). Curiosity and exploratory behavior. In H. F. O'Neil & M. Drillings (Eds.), *Motivation* (221-243). Hillsdale, NJ: Lawrence Erlbaum.
- Tabachnick, B. G., & Fidell, L. S. (1989). *Using multivariate statistics* (2nd ed.). New York: Harper Collins.
- Vidler, D. C., & Rawan, H. R. (1974). Construct validation of a scale of academic curiosity. *Psychological Reports*, *35*, 263-266.
- Voss, H., & Keller, H. (1983). *Curiosity and exploration*. New York: Academic Press.
- Vygotsky, L. S. (1986). *Thought and language*. Cambridge, MA: MIT Press.
- Woolfolk, A. E. (2001). *Educational psychology* (8th ed.). Boston: Allyn & Bacon.
- Zuckerman, M. (1979). *Sensation seeking*. New York: Cambridge University Press.
- Zuckerman, M. (1994). *Behavioral expressions and biosocial bases of sensation seeking*. New York: Lawrence Erlbaum.