Need for Cognition in Recall and Recognition Tasks

Melissa J. Hawthorne, Ph.D.

Louisiana State University-Shreveport

For any comments or questions for the author, contact Melissa Hawthorne at

melissa.hawthorne@lsus.edu

Abstract

Need for cognition (NFC), the extent to which individuals engage in and enjoy effortful thinking, is associated with various abilities that are important in education (e.g., intelligence, academic outcomes). Typically, students' education involves use of different types of memory. When students take an essay test, they draw predominantly on recall memory, whereas a multiple-choice test can be navigated using primarily recognition memory. Although this sits well as common wisdom, to date, very little research has examined the relationship between test taking and memory. In this study I examined how memory types can aid or inhibit academic performance, as indicated by their grade point averages. Participants completed two facial activities (one relying primarily on recognition memory and one relying on recall memory) and two vocabulary tasks. One vocabulary task relied primarily on recognition memory while the other relied on recall memory. The results showed that NFC is related to and predictive of success for recall tests but not for recognition tasks. In addition, students who scored higher in NFC did better on the recall tasks.

Keywords: need for cognition (NFC), recall memory, recognition memory, study strategies, academic success

Learning draws on both recall and recognition memory. Recall tasks require students to remember information without relying on cues and/or prompts (Stern & Hasselmo, 2009). In contrast, recognition memory tasks provide cues and tend to be easier than recall tasks (Rich, 2011; Liu & Nesbit, 2023). When it comes to testing, students take some exams that rely primarily on recall memory, like essay exams (Liu & Nesbit, 2023; Roediger & Karpicke, 2006), and other exams that rely primarily on recognition memory, like multiple-choice exams (Little & Bjork, 2014). Researchers have examined factors, such as self-efficacy (Honicke, et al., 2023; Schneider & Preckel, 2017) and intelligence (Blanco et al., 2022) which influence performance on both kinds of tests. In the current study, I compared differences in scores on two recall tasks and two recognition tasks and explored the extent to which NFC influenced student outcomes.

Literature review

Need for Cognition

Need for cognition is an inherent tendency to enjoy engaging in thinking activities (Cacioppo & Petty, 1982; Liu & Nesbit, 2023). People who have higher levels of need for cognition often engage in thinking about a variety of topics, enjoy the thinking process, and require little prompting to get them to engage their thinking skills (Bost, 2024). According to Liu and Nesbit (2023), "Need for cognition is not an intellectual capacity, but a cognitive motivation" (p. 2). Whereas intelligence describes a person's ability to acquire, understand, and apply knowledge and skills (Blanco et al., 2022), NFC describes a person's tendency to enjoy and engage in thinking (Cacioppo & Petty, 1982; Liu & Nesbit, 2023).

Research has indicated there is a relationship between NFC and student performance (Sadowski & Gulgoz, 1992; Liu & Nesbit, 2023) as well as between NFC and college students' reported satisfaction with their lives (Coutinho & Woolery, 2004; Zerna et al., 2024). Furthermore, Hawthorne and Sealey (2019) found that, for graduate students in an online program, students with higher levels of NFC reported greater satisfaction with the program and with their professors than did students with lower NFC. In contrast, individuals with low NFC tend to feel more anxiety and stress when faced with complex tasks, in part because they are not comfortable with cognitive challenges and have low levels of confidence in their ability to solve problems (Heppner, et al., 1983; Zerna et al., 2024).

Students who report a higher level of NFC often invest greater levels of effort in information-processing activities (Cacioppo et al., 1996; Fleischhauer et al., 2024) and are more likely to pay attention during cognitive tasks (Osberg, 1987; Zerna et al., 2024). They also tend to find and use relevant information for problem solving (Berzonsky & Sullivan, 1992) and are more likely to base judgments on deliberative, rational considerations rather than affective responses (Reuter et al., 2025, Zerna et al., 2024). They also tend to find and use relevant information for problem solving (Berzonsky & Sullivan, 1992) and are more likely to base judgments on deliberative, rational considerations rather than affective responses (Reuter et al., 2025; Zerna et al., 2024).

Both high school GPA (Weissgerber et al., 2018) and college GPA (Strobel et al, 2019) have positive correlations with NFC scores. Because students with high NFC enjoy and want to engage in cognitively demanding tasks (Reuter et al., 2025; Zerna et al., 2024)., they make a greater effort to seek out, acquire, and reflect on information relevant to the task (Jebb et al., 2016). This increased effort and enjoyment of the process tends to help students in their work.

In contrast, Conzola and Klein (1998) and a Wogalter et al. (2002) found that, when presented with product warnings, students with lower levels of NFC recalled more information about warning instructions. The authors hypothesized that a lack of guiding features designed to grab the students' attention would result in students with low NFC not engaging in deliberate cognitive processing. Coppens et al. (2019) failed to find a significant relationship between the

NFC and the transfer of problem-solving procedures from one task to the next. Warden and Myers (2017) found a negative correlation between NFC and GPA for students older than 25. Neigel et al. (2017) found that NFC and performance of standardized tests (e.g., SAT, ACT) were positively related.

Although Conzola and Klein (1998) found greater recall of warning instructions among individuals low in need for cognition (NFC), more recent research suggests that this effect is **context-specific.** Contemporary studies generally show that higher NFC is associated with deeper processing and better recall of complex or information-dense warnings; however, low-NFC individuals may recall simple, directive warning messages more effectively when such messages rely on salience rather than elaboration (Champlin, 2022; Zerna et al., 2024).

Research has indicated that students who have high NFC remembered more arguments from an editorial-style text passage than did their peers with low NFC (Cacioppo et al., 1983; Wagaman et al., 2025). Similarly, Champlin (2022) and Kuo et al. (2012) showed that participants with higher levels of NFC remembered more product features described in advertising. Furthermore, consistent with earlier findings by Kardash and Noel (2000), more recent evidence suggests that NFC is positively associated with recall-based memory performance but shows weaker or inconsistent relations with recognition tasks, reflecting the greater cognitive demands of self-initiated retrieval (Wagaman et al., 2025; Zerna et al., 2024). Given that the two types of memory require distinct levels of processing and have different levels of difficulty, it is reasonable to expect that they would have different requirements regarding NFC.

In the current study I examined the relationship between NFC on recall and recognition tasks. Although there is a large verbal component in learning materials, students also study diagrams and charts that rely more heavily on visual processing. Therefore, the experimental tasks included vocabulary tests and visual recognition tests, as both are relevant to learning.

Method

The goal of the current study was to compare the relationship between NFC scores and performance on recall and recognition tasks. After receiving IRB approval, students in a mid-sized university participated in a series of tasks. Two tasks were vocabulary recall or recognition tasks and two were visual recognition or recall tasks. The tasks were completed in random order with the exception that the visual recall task had to be completed before the visual recognition tasks. This was done to avoid order effects (the systematic influence of task sequence on performance) and fatigue effects (a decline in performance due to participant becoming tired).

Participants

After IRB approval and participant consent was received, 146 undergraduate students participated in the study. Participants consisted of 48 males and 98 females with an age range from 18 to 48 (mean age = 21.7 years). For other participant demographics, see Table 1.

Table 1

Participant Demographics

Demographic	Elements	Number
Race/Ethnicity	African American	29
	White	85
	Latinx	28
	Biracial/Multicultural	3
	No response	1
Class	First-Year	15
	Sophomore	27

	Junior	60
	Senior	20
Generation	First generation	50
	Second generation	96

Materials and Procedure

After completing the informed consent document, participants completed a demographic form and each task. Participants completed all tasks, except for distractor tasks (i.e., completing mazes), on the laboratory computers. The tasks were programmed using E-Prime and were presented on Dell UltraSharp 24-inch monitors. Participants also completed 3 minutes of mazes between tasks.

Vocabulary Task

In this task, participants saw 20 word-pairs (e.g., toy; banana). The word pairs were matched for length, difficulty, forward associative strength (the strength of association from cue to target, and backwards associative strength (the strength of association from target to cue). Participants studied each word pair for 30 seconds. A blank screen appeared for 3 seconds after each word pair, then the next word pair would appear. After studying the word pairs, participants spent 3 minutes completing mazes. For the test phase, participants saw the first word of each word pair and provided the second word. Participants typed their answer using a Dell wireless keyboard.

Word-Pairs Task

Participants studied 20 word-pairs (e.g., house, car). The word pairs were matched for length, difficulty, forward associative strength, and backwards associative strength. Participants saw each word pair presented for 30 seconds each, then a blank screen appeared for 3 seconds followed by the next set of word pairs. After studying the word pairs, participants spent 3 minutes completing mazes. Finally, participants saw a set of 30 word-pairs and judged whether they had studied each word-pair. Participants pressed the “a” key for Yes and the “l” key for No. Labels on the keys facilitated participant response.

Face-Name Task

Participants studied 36 face-name pairs. Each face-name pair was presented for 30 seconds. The names were chosen from the top 50 most common names in the United States (Forebears, 2021) to avoid any distinctiveness effects, and the faces were taken from Experiment 4 of the Bartlett et al. (2009) facial recognition study (used with permission) (see Figure 1). The use of black and white photos reduced potentially distinctive characteristics, such as hair and eye color. The photos were split equally between females and males. The pictures, which were presented using E-prime, appeared in random order for each participant.

Figure 1

Sample face/name pairs

Faces Recall Test

Participants saw each face along with a prompt for the participant to enter the name that matched the face. Participants used the keyboard to type the name they recalled belonging with the face. The test phase was self-paced. The recall test always occurred prior to the recognition test to lessen the chance of task overlap influencing participant recall.

Faces Recognition Test

Participants saw each face one at a time accompanied by two names. Participants chose the name belonging to the face by pressing the number associated with the name. Participants pressed the “r” key if they thought the name on the right side of the screen was the correct name; similarly, they pressed the “l” key for the name on the left side of the screen. Labels on the keys facilitated participant response. Participant responses were self-paced.

Need for Cognition Task

This task consisted of eighteen statements and asked participants to rate the extent to which they agreed with each statement (Cacioppo et al., 1984). The statements were designed to assess participants’ level of cognitive engagement and enjoyment of complex thinking. The questions were presented as a Likert format with 1 being “extremely uncharacteristic” to 5 being “extremely characteristic.” To minimize bias, some statements were reverse scored. Higher scores indicated a greater level of need for cognition.

Results

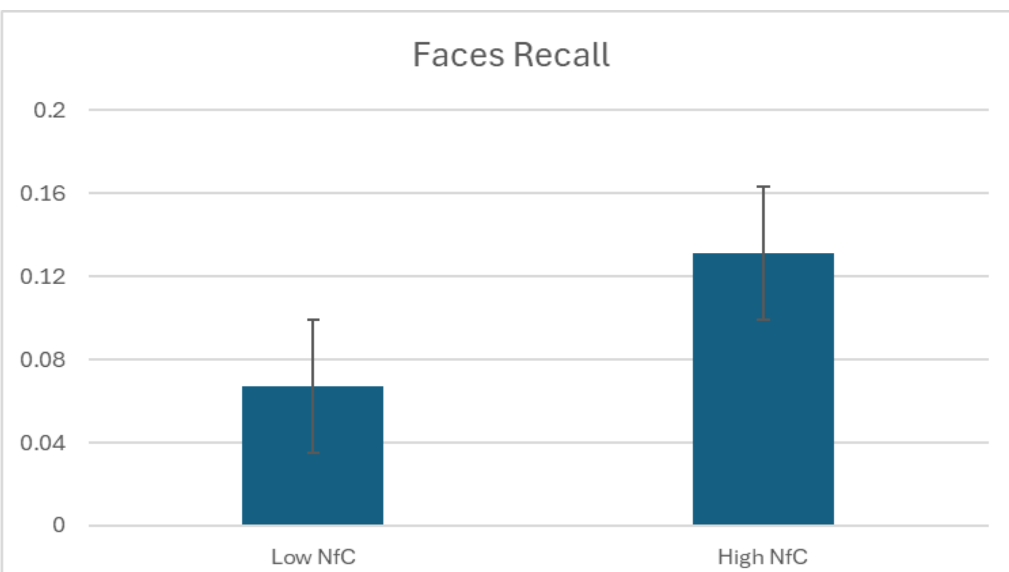
A Pearson correlation analysis revealed that NFC was positively correlated with the vocabulary task, $r = .300$, $p = .043$, and the faces recall task, $r = .441$, $p = .003$, but not with the word pairs task, $r = .064$, $p = .667$, or the faces recognition task, $r = .042$, $p = .781$.

Next, two multiple linear regression analyses using the enter method were conducted using NFC as the predictor variable; faces recall and the vocabulary measure were the criterion variables. A Bonferroni correction (1936) was used to limit the effect of type 1 error (p = .025). The results showed that for the vocabulary measure, NFC accounted for 9% or the variance in scores (r^2 = .09; adjusted r^2 = .07). NFC was a significant predictor of vocabulary score, β = .004, t = 2.09, p = .004. For the faces recall task, NFC was a significant predictor, β = .005, t = 3.18, p = .003, and accounted for 19% of the variance, r^2 = .194, adjusted r^2 = .175).

Next, two independent sample t-tests were conducted using NFC as the independent variable; faces recall and the vocabulary measure were the dependent variables (see Figure 2). A Bonferroni correction limited the effect of type 1 error (p = .025). The results showed that for the faces task, participants with higher levels of NFC scored better than participants with lower levels of NFC, t = 4.135, p < .001, Cohen's d = .11.

Figure 2

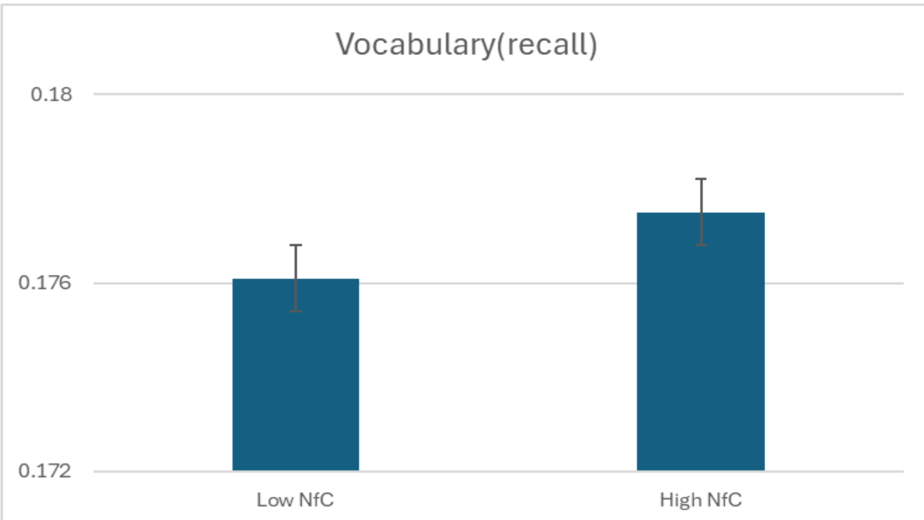
Differences in Faces Recall Score Based on NFC



However, the same was not true for the vocabulary task, *t* = .057, *p* = .477, Cohen's *d* = .08 (see Figure 3).

Figure 3

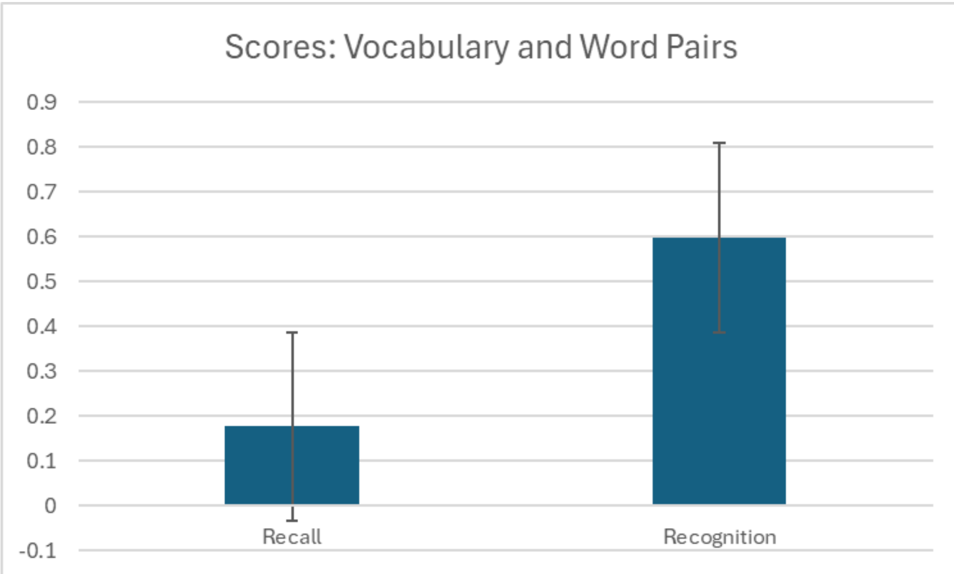
Differences in Vocabulary Score Based on NFC



Finally, to determine whether recall tasks are more difficult than recognition tasks, I used two paired sample *t*-tests to check for differences between the vocabulary task and the word pairs task and between the faces recall task and the faces recognition task. A Bonferroni correction limited the effect of type 1 error (*p* = .025). The results indicated that the vocabulary task was more difficult than the word pairs task, *t* = 13.37, *p* < .001, Cohen's *d* = 1.471 (see Figure 4).

Figure 4

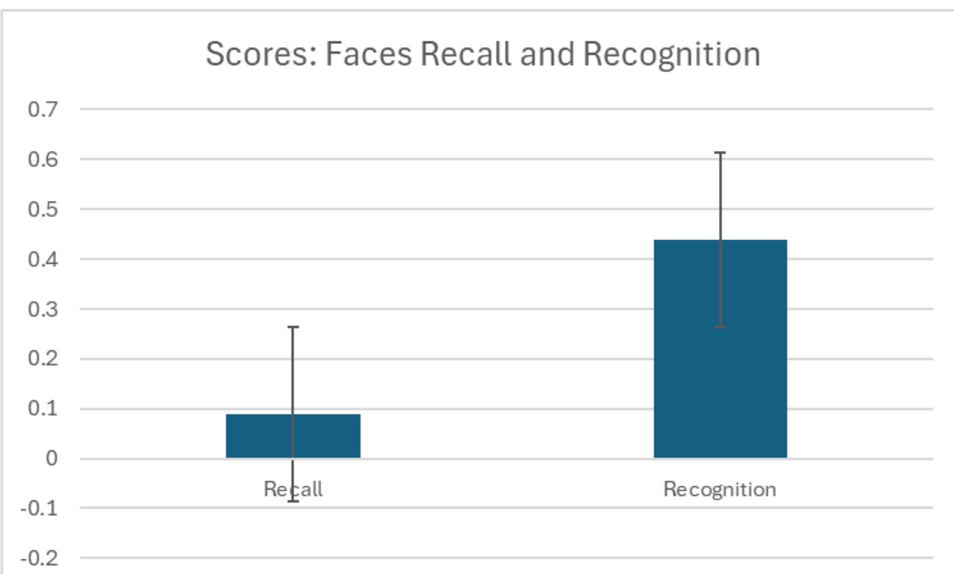
Differences Between Vocabulary (Recall) & Word Pairs (Recognition)



Similarly, the faces recall task was harder than the faces recognition task, *t* – 21.07, $p < .001$, *Cohen's d* = 2.44 (see Figure 5).

Figure 5

Differences in Scores Between Faces Recall & Faces Recognition Tasks



Discussion

Need for cognition is linked to higher academic achievement, perhaps because it promotes deeper processing of information, is associated with higher levels of control, and can compensate for poor reasoning skills (Zerna et al., 2024). From my analysis of the data, I concluded the association between academic success and NFC likely comes from teacher preference for using deep learning activities, that are found in students with higher NFC, rather than repetition and memorization. I expected that NFC would influence recall tasks more than recognition tasks given that recall requires greater cognitive effort and self-initiated retrieval processes than recognition (Rich, 2011; Wagaman et al., 2025; Zerna et al., 2024). The results somewhat supported this contention with NFC levels predicting performance on the verbal and visual recall tasks but not on the recognition tasks. However, when I applied a median split and analyzed the effects of having a higher NFC, only the Faces Recall test showed a significant difference on scores.

Limitations and Future Research

One limitation of the study is the low scores students tend to have on some tasks. It is possible that task difficulty influenced or interfered with the impact of NFC levels. Further research is needed to clarify the role of task difficulty and interference with NFC's influence on recall and recognition tasks.

The photos used were also limited. Although the decision to use black and white photos was made to reduce distinctive features, using color pictures could give a different response. Having features such as hair color could provide markers and guides to help enhance memory in one, or both, groups (i.e., high in NFC and low in NFC). A study using color photos is needed to address this question.

Conclusion

Having higher levels of NFC is related to better academic outcomes (Sadowski & Gulgoz, 1992; Liu & Nesbit, 2023), particularly when tests involve recall memory. However, students with lower levels of NFC do equally well on tests of recognition memory (Wagaman et al., 2025; Zerna et al., 2024). A better understanding of NFC will help teachers and students understand performance differences between test types. In turn, this understanding can lead to better study strategies for students (Liu & Nesbit, 2023).

Although need for cognition is typically considered to be like a personality trait, some researchers (i.e., Cacioppo et al. 1996; Jebb et al., 2016) have determined that the trait is malleable. Research has suggested that NFC may be shaped by educational and social experiences, including interactions with faculty, as well as broader developmental and contextual factors (Aerts et al., 2024; Liu & Nesbit, 2023; Padgett et al., 2010). Students should also be encouraged to extend their interest in reading materials, which connects to improvement across various measures of intelligence (Jebb, et al, 2016). Another approach involves exposing people who are low in NFC to learning situations where they will be successful (e.g., more recognition memory tasks and assessments). Over time, NFC may become a self-reinforcing pattern of behavior, if supported by teachers. If the need for cognition itself becomes rewarding, it might also become self-motivating (James, n.d.)

Knowing a student's NFC level would allow for matching the student with the correct resources. For example, a student with high NFC could be matched with content that inspires deep thinking whereas a student with low NFC might prefer content that moves quickly while covering the basic information (James, n.d.). In addition, someone with low NFC would need more external motivators than someone with higher NFC. Although teachers probably would not know a student's NFC, they can be aware of their students' attitudes toward different task requirements and adapt their learning program to fit each type of student (James, n.d.).

For teachers, there are several ways to encourage the development of NFC. Students require a safe learning environment where they can take on challenging tasks (Visser, 2024). Offering optimal challenges (i.e., ones that are slightly above the student's current skill level) increases the chances of success, which in turn can lead to higher NFC. Teachers can ensure success by providing structure to tasks, adapting materials and methods to the needs of the students, and giving constructive feedback (Visser, 2024). Furthermore, teachers can give students tasks that match their interests and encourage them to reflect on why the activities are important to them. Teachers can also serve as role models by engaging in and showing enthusiasm for cognitively challenging tasks. Applying strategies that enhance students' self-efficiency and their appreciation of cognitive challenges, teachers can help develop life-time learning in students.

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Consent to participate: All participants provided consent through the Prolific electronic signing feature.

References

Bartlett, J. C., Shastri, K. K., Abdi, H., & Neville-Smith, M. (2009). Component structure of individual differences in true and false recognition of faces. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *35,* 1207–1230. https://doi.org/10.1037/a0016368

Berzonsky, M. D., & Sullivan C. (1992). Social-cognitive aspects of identity style: Need for cognition, experiential openness, and introspection. *Journal of Adolescent Research*, *7*(2), 140–155. https://doi.org/10.1177/074355489272002

Blanco, R. L., Quílez-Robres A., Usán P., Salavera, C., & Casanovas- López (2022). Types of intelligence and academic performance: A systemic review and meta-analysis, *Journal of Intelligence, 14*(4):123. https://doi.org/10.3390/jintelligence10040123

Bonferroni, C. E. (1936). Teoria statistica delle classi e calcolo delle probabilit `a. *Pubblicazioni del R Istituto Superiore di Scienze Economiche e Commerciali di Firenze, 8*, 3–62.

Bost, A. (2024). The need for cognition scale. Center of Inquiry at Wabash College. https://centerofinquiry.org/uncategorized/need-for-cognition-scale-wabash-national-study/

Cacioppo, J. T., & Petty, R. E. (1982). The need for cognition. *Journal of Personality and Social Psychology*, *42,* 116–131. https://doi.org/10.1037/0022-3514.42.1.116

Cacioppo J. T., Petty R. E., Feinstein J. A., & Jarvis B. W. (1996). Dispositional differences in cognitive motivation: The life and times of individuals varying in the need for cognition. *Psychological Bulletin, 119*, 197–253. https://doi.org/10.1037/0033-2909.119.2.197

Cacioppo, J. T., Petty, R. E., & Kao, C. F. (1984). The efficient assessment of need for cognition. *Journal of Personality Assessment*, *48*, 306–307. https://doi.org/10.1207/s15327752jpa4803_13

Cacioppo, J. T., Petty, R. E., & Morris, K. J. (1983). Effects of need for cognition on message evaluation, recall, and persuasion. *Journal of Personality and Social Psychology*, *45*, 805–818. https://doi.org/10.1037/0022-3514.45.4.805

Champlin, S. (2022). Information overload: Examining the cognitive and affective factors that influence perceived ability to acquire food recall information. *Current Psychology*, *41*, 7297–7300. https://doi.org/10.1007/s12144-020-01293-z

Conzola, V. C., & Klein, K. W. (1998). Need for cognition: An individual differences approach to understanding warning effectiveness. In *Proceedings of the Human Factors Society 42nd Annual Meeting* (811–815). https://doi.org/10.1177/154193129804201109

Coppens, L. C., Hoogerheide, V. Snippe, E. M., Flunger, B., & van Gog, T. (2019). Effects of problem-example and example-problem pairs on gifted and nongifted primary school students’ learning. *Instructional Science*, *47*(3), 279–297. https://doi.org/10.1007/s11251-019-09484-3

Coutinho, S. A., & Woolery, L. M. (2004). The need for cognition and life satisfaction among college students. *College Student Journal*, *38*(2), 203–206. https://web.mit.edu/curhan/www/docs/Articles/biases/Coutinho_Woolery_Need_for_Cognition_Life_Satisfaction.pdf

Fleischhauer, M., Schweitzer, F. M., & Enge, S. (2024). Yes, I can: The interplay of need for cognition and task confidence in cognitive task performance. *Journal of Intelligence*, *12*(12), 128. https://doi.org/10.3390/jintelligence12120128

Forebears. (2021). Most common first names in the United States. https://forebears.io/united-states/forenames

Hawthorne, M. J**.,** & Sealey, J. V. (2019). Academic coaching in an online environment: impact on student achievement. In M. Shelley & V. Akerson (Eds.), *Proceedings of IConSES 2019--International Conference on Social and Education Sciences*, 122–126. Monument, CO, USA: ISTES Organization. https://files.eric.ed.gov/fulltext/ED625824.pdf

Heppner, P. P., Reeder, B. L., & Larson, L. M. (1983). Cognitive variables associated with personal problem-solving appraisal: Implications for counseling. *Journal of Counseling Psychology*, *30*(4), 31–42. https://doi.org/10.1037/0022-0167.30.4.537

Honicke, T., Broadbent, J., & Fuller-Tyszkiewicz. (2023). The self-efficacy and academic performance reciprocal relationship: The influence of task difficulty and baseline achievement on learner trajectory. *Higher Education Research & Development, 42*(8), 1936–1853. https://doi.org/10.1080/07294360.2023.2197194

James, D. (n.d.). Need for cognition: How to inspire the 3 types of learner curiosity. 360 learning. https://360learning.com/blog/need-for-cognition

Jebb, A. T., Saef, R., Parrigon, S., & Woo, S. E. (2016). The need for cognition: Key concepts, assessments, and role in educational outcomes. In A. Lipnevich, F. Preckel, & R. D. Roberts (Eds.). *Psychosocial skills and school systems in the 21st century: Theory, research, and application*. (pp. 115–132). Springer.

Kardash, C. M., & Noel, L. K. (2000). How organizational signals, need for cognition, and verbal ability affects text recall and recognition. *Contemporary Educational Psychology*, *25*, 317–331. https://doi.org/10.1006/ceps.1999.1011

Kuo, J-C., Horng, D-J., Lin, C-L., & Lee, S-H. (2012). The causal relationship between need for cognition and advertising recall. *Social Behavior and Personalit*y, *40*(6), 1025–1032. http://jjdx.doi.org/10.2224/sbp.2012.40.6.1025

Little, J. I., & Bjork, E. L. (2014). Optimizing multiple-choice tests as tools for learning. *Memory and Cognition*, *43*(1), 14–26. https://doi.org/10.3758/s13421-014-0452-8

Liu, Q., & Nesbit, J. C. (2023). The relationship between need for cognition and academic achievement: A meta-analysis. *Review of Educational Research, 0*(0). https://doi.org/10.3102/00346543231160474

Neigel, A. R., Behairy, S., & Szalma, J. L. (2017). Need for cognition and motivation differently contribute to student performance. *Journal of Cognitive Education and Psychology*, *16*(2), 144–156. https://doi.org/10.1891/1945-8959.16.2.144

Osberg T. M. (1987). The convergent and discriminant validity of the Need for Cognition Scale. *Journal of Personality Assessment*, *51*, 441–450. https://doi.org/10.1207/s15327752jpa5103_11

Padgett, R. D., Goodman, K. M., Johnson, M. P., Saichaie, K., Umbach, P. D., & Pascarella, E. T. (2010). The impact of college student socialization, social class, and race on need for cognition. *New Directions for Institutional Research*, *145*, 99–111. https://doi.org/10.1002/ir.324

Reuter, M. A., Enge, S., & Fleischhauer, M. (2025). The role of need for cognition and perceived self-efficacy in modulating emotional and behavioural responses to failure. *BMC Psychology*, 13, 1009. https://doi.org/10.1186/s40359-025-03383-8

Rich, J.B. (2011). Recognition Memory. In J. S. Kreutzer, J. DeLuca, & B. Caplan, B. (Eds) *Encyclopedia of clinical neuropsychology*. Springer. https://doi.org/10.1007/978-0-387-79948-3_1148

Roediger, H. L., & Karpicke, J. D. (2006). Test-enhanced learning: Taking memory tests improves long-term retention. *Psychological Science*, *12*(3), 181–186. https://doi.org/10.1111/j.1467-9280.2006.01693

Sadowski, C. J., & Gulgoz, S., (1992). Association of need for cognition and course performance. *Perceptual and Motor Skills*, *72*(2), 498–498. https://doi.org/10.2466/pms.1992.74.2.4

Schneider, M., & Preckel, F. (2017). Variables associated with achievement in higher education: A systematic review and meta-analysis. *Psychological Bulletin*, *143*(6), 565–600. https://doi.org/10.1037/bul0000098

Stern, C. E., & Hasselmo, M. E. (2009) Recognition memory paradigms. In L. R. Squire (Ed). *Encyclopedia of neuroscience*. Elsevier.

Strobel, A., Behnke, A., Gärtner, A., & Strobel, A. (2019, July). The interplay of intelligence and need for cognition in predicting school grades: A retrospective study. *Personality and Individual Differences*, *144*, 147–152. https://doi.org/10.1016/j.paid.2019.02.041

Visser, C. (2024, October 18). Need for cognition in young people: Development and stimulation. *Progress-focused.* https://www.progressfocused.com/2024/10/need-for-cognition-in-young-people.html

Wagaman, B. N., Ikonomou, V. C., Campbell, I. A., Borgogna, N. C., Aita, S. L., Elliot, E. M., & Hill, B. D. (2025, July). Context matters: Need for cognition moderates immediate story recall but not other types of memory tests. http://dx.doi.org/10.2139/ssrn.5337691

Warden, N. D., & Meyers, C. A. (2017). Nonintellective variables and nontraditional college students: A domain-based investigation of academic achievement. *College Student Journal*, *51*(3), 380–390. https://www.thefreelibrary.com/Nonintellective+variables+and+nontraditional+college+students%3a+A...-a0507012096

Weissgerber, S. C., Reinhard, M. A., & Schindler, S. (2018). Learning the hard way: Need for cognition influences attitudes toward and self-reported use of desirable difficulties *Educational Psychology*, *38*(2), 176–202. https://dpi.org/10.1080/01443410.2017.1387644

Wogalter, M. S., Conzola, V. C., & Smith-Jackson, T L. (2002). Research-based guidelines for warning design and evaluation. *Applied Ergonomics*, *33*(2), 219–230. Elsevier. https://www.safetyhumanfactors.org/wp-content/uploads/2020/07/224)Wogalter,Conzola,SmithJackson(2002).pdf

Zerna, J., Stroble, A., & Strobel, A. (2024). The role of need for cognition in well-being: Review and meta-analysis of associations and potentially underlying mechanisms. *Collabra: Psychology, 10*(1), 92885. https://doi.org/10.1525/collabra.92885