

## An argument for implementing and testing novelty in the classroom

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### **Abstract:**

Based on the tenets of self-determination theory, intrinsic motivation is guided by satisfaction of the 3 basic psychological needs—autonomy, competence, and relatedness. However, recent research has shown promise for adding a new basic psychological need—novelty—in self-determination theory. This article briefly discusses the theory behind novelty as a motivator in the classroom, as well as its effect in technology and learning and future directions for research. As a motivator, novelty has mixed and complex outcomes in the classroom. Balancing novelty and familiarity, or scaffolding, is a common and effective pedagogical practice. Technology is now commonly used as a novel factor in the classroom, although can prove to be expensive. The largest drawback to novelty is its ability to become familiar, therefore instructors must understand what a student has previously experienced and continue to adapt practices to create subjective novelty for their students. Further experimental research is needed to explore the effects of novel teaching practices, including the use of technology, on student motivation and learning outcomes.

**Keywords:** novelty | pedagogy | self-determination theory | motivation | technology

### **Article:**

For most, if not all, instructors, the ideal student would be intrinsically motivated; in other words, learning for the personal enjoyment of the subject or topic. In 2018, only 58.31% of students who enrolled in a 2- or 4- year program graduated within 6 years (Shapiro et al., 2018). While many factors play a role in this statistic, research on student performance in higher education consistently shows that intrinsic motivation is positively related to success in academic outcomes (Lepper, Corpus, & Iyengar, 2005), making it a worthwhile topic to investigate. With the looming “enrollment cliff”—a combination of a declining population of college age adults, cost-barriers, and questionable need for ubiquitous higher education—it may become more important to examine “not what the professor teaches as much as how the professor teaches” (Grawe, 2018, paragraph, 11), hinting that student interest and continued enrollment can be affected by the approach of the instructor.

What motivates your students? It is well established that satisfaction of the three basic psychological needs—autonomy, competence, and relatedness—promotes intrinsic motivation (Deci & Ryan, 1985; Ryan & Deci, 2000). Recently, novelty has been proposed as a fourth basic psychological need—the need to experience something novel or deviating from normal routine—

and is shown to predict life satisfaction and intrinsic motivation beyond the three existing needs (González-Cutre, Sicilia, Sierra, Ferriz, & Hagger, 2016). By implementing unfamiliar situations in the classroom, an instructor can potentially create an environment that fosters students' intrinsic motivation. However, this research was conducted on physical education students and was a correlational study, paving the way for experimental research.

Although the importance of novel stimuli in the classroom has been explained in classical conditioning (Pavlov, 1927) driven by biological and behavioral processes, pairing new and old stimuli to elicit conditioned responses, scarce research has examined novelty from the perspective of self-determination theory (SDT; Deci & Ryan, 1985) driven by social and cognitive processes—satisfying basic psychological needs to foster intrinsic motivation and human functioning. Using a SDT perspective, our pedagogical points to ponder aim to encourage instructors to consider how teaching practices that their students would perceive novel, such as breaking up a lecture with short activities that involve various senses, and novel technology (e.g., Kahoot, Snapchat, Flipgrid) may enhance student motivation and learning outcomes. We summarize current findings of the effects of novelty perception under SDT on motivation in the classroom, as well as examine drawbacks of novelty in the classroom, and suggest directions for future research.

### **Self-Determination Theory and Novelty**

SDT, a commonly used theory of motivation in education, posits three basic psychological needs: (a) autonomy—the need to feel in control of one's own life, (b) relatedness—the need to interact and be connected to others, and (c) competence—the need to experience mastery. Satisfaction of these needs is necessary for optimal development and wellness (Ryan & Deci, 2000) by driving intrinsic motivation, adaptive development, and personal well-being (Deci & Ryan, 1985).

SDT defined intrinsic motivation as “active engagement with tasks that people find interesting, and that, in turn, promotes growth. Such activities are characterized by novelty . . . and by optimal challenge” (Deci & Ryan, 2000, p. 233); the attention is directed toward “activities that have the appeal of novelty” (Ryan & Deci, 2000, p. 71). Therefore, novel experiences may both influence and be influenced by intrinsic motivation. For example, students who are intrinsically motivated to study motivation are likely to explore research or topics that discuss motivation. They may seek out new opportunities to learn more, such as checking out textbooks, talking to professors, and perhaps conducting research on this topic, which satisfies their need for novelty and enhances their intrinsic motivation to learn more.

Under SDT, novelty is defined as “the need to experience something not previously experienced or deviates from everyday routine” (González-Cutre et al., 2016, p. 159). In this vein, it is the perception of novelty, rather than novel stimuli, that is studied. Therefore, teaching and learning strategies do not need to be objectively “new,” if students subjectively perceive them as such. For instance, asking students to make presentations is not new; however, when introducing presentation tools (e.g., Prezi, Canva) that students have not previously experienced and requiring them to use one of the tools for presentations, the second author notes that students tend to report more fun and interest than using PowerPoint. Hence, instructors need to get to know their students beforehand to understand what they have and have not experienced in terms of teaching and learning strategies.

## **The von Restorff Effect**

Extensive research has provided evidence that novelty influences the amount and the depth of our information processing—the “von Restorff effect” (Hastie, 1981). The von Restorff effect states that when multiple similar stimuli are presented, the stimulus that differs, or evokes a perception of novelty, has a higher likelihood of being remembered. Applying this effect to pedagogy is likely to promote learning by generating interest, increasing motivation, and creating an environment where strong knowledge structures can be constructed (Kenny, 2015). In psychology, this effect may be manifested through atypical classroom activities (e.g., active learning and gamification; see Hartnett, 2020; Swope, 2011).

One way the von Restorff effect is possibly demonstrated in the classroom is through scaffolding. Scaffolding balances familiarity and novelty controlling what is initially outside of a student’s capability to focus attention on what the student can do (Simons & Klein, 2007). Slowly expanding what the student is capable of, based on previous learning experiences, can increase engagement (Koops, 2017, 2018) inquiry and performance (Simons & Klein, 2007). Scaffolding may be successful because it allows for growth in competence while engaging students’ curiosity and novelty perception (De Jonge, Rietzschel, & Van Yperen, 2018). Its implementation in research methods in psychology promotes higher levels of writing efficacy, better attitudes toward statistics, and higher perceived skills/abilities in statistics (Ciarocco, Lewandowski, & Van Volkom, 2013). For instance, as a research methods course instructor, the second author collects data from students who act as participants to complete an instructor-designed hypothetical study on the first class day, and then show students how to design an experiment, organize and analyze those data, write the method and results sections over the course of the semester. After participating in the study and familiarizing themselves with the study, students often report feeling more comfortable and confident in working on those tasks for their only project that they need to complete throughout the semester.

Changing classroom practices to reject the norm may also embody the von Restorff effect because it creates a comparison group. Research has indicated that compared with doing traditional textbook readings, students in a research methods course who read, critiqued, and discussed articles, were given in-class demonstrations, and implemented a small-scale study reported stronger self-efficacy in writing and statistics (Ciarocco et al., 2013). The in-class demonstrations provided deep processing for students to complete their hands-on project through expert scaffolding, retrieval practice, and self-regulation (Holton & Clarke, 2006; Simons & Klein, 2007). This classroom experience ultimately raised their perception of the utility of research principles when compared to a group who did not do these interactive learning activities.

Novel activities do not need to be extravagant; even simple modifications of traditional lessons can increase perceptions of novelty. For instance, implementing trivia-type review games (e.g., Kahoot, Jeopardy, clickers) can motivate students to engage in exam review sessions (Stachowski & Hamilton, 2019). Using the aforementioned teaching methods draws upon the von Restorff effect and other learning processes, such as increased self-efficacy, motivation, and engagement to increase performance (Bechkoff, 2019). Making modifications in these ways to classroom practices to differ from the norm may be enough to employ processes such as the von Restorff effect.

## Novelty in the Classroom

The concept of novelty is not new to the pedagogical world, but very little empirical evidence exists of its implications. Piaget (1969) and Kagan (1972) argue that children's efforts to understand the unknown is key to their development. In this vein, encouraging curiosity and celebrating novelty in the classroom should increase intrinsic motivation. Lubow, Rifkin, and Alek (1976) suggested that "enhancement of learning is achieved when a new stimulus is presented in an old environment or an old stimulus in a new environment" (p. 38), thereby in either case simulating a perception of novelty. However, by the definition of novelty through SDT, new stimuli are not necessary, rather, the subjective perception of novelty will also increase interest and performance (González-Cutre et al., 2016). For example, although gamification is not a new stimulus, a student who has never encountered a class with gamification may perceive the class as more novel and have a higher interest in the material (Bechkoff, 2019).

Incorporating novelty into education has many benefits. Novel activities in physical education is related to an increase in physical activity (Huang & Gao, 2013) and increased interest in new activities (Timken, McNamee, & Coste, 2019). Beyond physical education, novelty satisfaction is significantly and positively associated with active engagement, satisfaction, and attitudes toward autonomous learning (Birdsell, 2018). González-Cutre et al. (2016) conducted the first novelty study through the lens of SDT and found that, in the context of physical education classes, satisfaction of the need for novelty was an independent predictor of intrinsic motivation over and above the effects of autonomy, competence, and relatedness. These researchers conducted further studies on the role of novelty in exercise and general life contexts, providing preliminary support of novelty as an additional candidate need. Specifically, novelty positively predicted autonomous motivation and vitality as well as adaptive outcomes and optimal functioning in life (González-Cutre, Romero-Elías, Jiménez-Loaisa, Beltrán-Carrillo, & Hagger, 2020). These findings imply that novelty can be used as a motivator.

Instructors play a large role in developing students' intrinsic motivation in novel situations. For example, when introducing a new subject as a novel situation, students use their instructors' social cues to understand how much autonomy they will have and how much they will enjoy the lesson, while also being aware of the perceptions of autonomy in an unfamiliar situation shared by their classmates (Thomas & Mueller, 2017). The culture formed by instructors can make it easier or harder to incorporate novelty. One way to incorporate novelty is to personalize education, which increases situational interest by changing the traditional one-size-fits-all lecture approach to tailoring to the individual student, which creates a perception of "novelty" to the student. Personalized education represents a source of novelty to students because personalized interest (a) is not the norm and represents novelty to many and (b) forces the instructor to understand what the student has experienced in the past and would not consider to be novel and (c) may create a need to constantly innovate teaching practices to instill perceptions of novelty for the student. Reber, Canning, and Harackiewicz (2018) comprised a review of studies examining situational interest and proposed three main methods to personalize education: (a) context personalization, where the learning contents and tasks are customized to the individual student; (b) provision of learning choices, by allowing students to make a choice, thereby increasing autonomy support; and (c) active personalization, where students create a connection between the learning material and their interest. These three methods have been observed to increase situational interest in the short-term ranging from education in middle school to undergraduate studies, not only because of its novelty, but also because of other factors, such as student-faculty rapport (see Reber et al., 2018).

Personalizing education to add novelty could be as simple as tailoring content to current news (e.g., coronavirus research and news) into topic (e.g., validity) discussions.

### **Novel Technology in the Classroom**

The relative newness of technologies, from smart boards to smart phones, draws interest and use in many contexts, including the classroom. The recent COVID-19 pandemic has forced both instructors and students to quickly adapt to online classroom practices often via conference video platforms. This may have been in the form of increased use of flipped classroom, breaking a virtual lecture into small components interspersed with short learning activities, providing a mix of high quality premade online tutorials, or collaborating with learners to create online resources (Sandars et al., 2020). This is not to say that incorporating novelty in this sense automatically makes instructors better, but instead may present a case that novelty should be experienced in congruence with autonomy, competence, and relatedness support.

Using technology is often self-selected and hence, an intrinsically motivated activity (Rigby & Ryan, 2017), making it seem like a quick fix to low motivation. However, instructors must be aware of the law of diminishing returns. Perceived novelty increases motivation initially but decreases as the user, whether a student or instructor, becomes accustomed to it (Keller & Suzuki, 2004). Burke and James (2008) found a positive association between novel perceptions of PowerPoint and cognitive understanding of course material. Consequently, they also found a negative association between novel perceptions of PowerPoint and boredom. Therefore, instructors should support autonomy, competence, and relatedness along with novelty, as well as implement an instructional style that emphasizes and enhances the perception of novelty despite using the same technological tools (Ryan & Rigby, 2019). For example, instructors can amplify the novel aspects of new contents and materials through connecting them to what students have already learned, while highlighting what is new and different. This teaching practice can also support competence by helping students feel confident in using their existing knowledge to solve new problems.

Learning from “cutting-edge” devices, can satisfy other basic psychological needs, which in turn increases achievement and internalization of learning (Jeno et al., 2019). Specifically, technology, accompanied with an instructional style that supports autonomy, relatedness, and competence, allows for satisfaction of autonomy through self-paced and self-selected learning, increased feelings of competence through instant feedback, and a sense of relatedness through low-stake communication with easier access to both instructors and peers. However, using novel technology continuously in the classroom can shift motivation from an intrinsic to an extrinsic motivator: grades (Jeno et al., 2019). Because the student is forced to use the technology to complete their class homework for points, novel technology no longer draws intrinsic interest. Hence, classroom use of technology must be scrutinized to aid in the completion of learning goals, such as increasing engagement or for review sessions (Sanchez, Langer, & Kaur, 2019; Son & Rivas, 2016; Stachowski & Hamilton, 2019), but not be entirely depended on to motivate students.

### **Drawbacks to Novelty**

Despite the positive effects of novelty on motivation, there are times when novelty may not be perceived as necessary or helpful. Because of the tendency for minds to wander and the many distractions that can be present in a classroom, instead of constantly providing novel situations,

repetitions through priming, scaffolding, and spacing of materials can promote memory storage and retrieval (see Carpenter & Agarwal, 2019 for more information on spacing).

Novelty can be perceived as a threat in certain learning contexts. In research methods courses, students are unfamiliar with many activities and topics, which increases anxiety due to perceived difficulty (Harlow, Burkholder, & Jennifer, 2009). Novelty (or unfamiliarity) in the classroom should therefore be paired with satisfaction of the other psychological needs, particularly autonomy and competence, to promote intrinsic motivation (Sibold, 2016). A simple way to increase competence is to offer low-stake assignments and quizzes on which students can test their learning and receive feedback without worrying about lowering their grade. Personalized positive and constructive feedback from the instructor can foster perceptions of competence; choice of topic, activity, or even instructionally irrelevant activities, such as creating group names, are an effective way to increase autonomy in the classroom (Reber et al., 2018).

As mentioned previously, a large drawback to novelty relates to the law of diminishing returns. After all, by the very definition of novelty, it is necessary to constantly, but not necessarily predictably, induce a perception of newness in order to achieve enhanced responses (González-Cutre et al., 2016; Schomaker & Meeter, 2018). If novelty is being presented in the form of technology, the financial cost of constantly updating the technology can quickly add up. On the other hand, relying on instructors to change methods and frequently incorporate novelty or novel practices is not necessarily cost-effective (Blouin et al., 2009). Novelty should be thoughtfully introduced to the classroom not merely for the sake of novelty, but to be used to achieve educational success.

### **Future Research in Novelty**

Research could go many directions to examine aspects of novelty in the classroom by adding novelty to SDT studies (Bagheri & Milyavskaya, 2019; González-Cutre et al., 2016). Although preliminary correlational evidence indicates that novelty could be a fourth psychological need, experimental research is needed to test this tenet, particularly in the classroom. These findings beg the questions: Can simply changing teaching practices to increase perceptions of novelty enhance motivation in students? If so, what kinds of novel practices (e.g., instructional style, content delivery, course material) are most effective? How do novel learning technologies change how learning is conducted (e.g., online gamification, online courses, and distance learning)?

Experimental research is needed to explore the effects of technology as a conductor of novelty on learning outcomes. Moreover, applied research is needed to examine novelty in postsecondary education, such as investigating the long-term effects of novel classroom practices and incorporating novelty into online learning. The many ways to address novelty in the classroom leaves much room for exploratory research, particularly to build on González-Cutre et al. (2016), exploring associations between perceptions of novelty and learning. Additionally, physiological and theoretical research suggests that the intersection of perceptions of surprise and novelty in the classroom may be of worthwhile investigation (Barto, Mirolli, & Baldassarre, 2013; Schomaker & Meeter, 2015).

Educational trends are leaning away from the traditional lecture and are exploring options such as the flipped classroom (Covill & Cook, 2019), gamified learning (Plummer, 2019), activity guided learning (e.g., Ciarocco et al., 2013), and opportunities through technology such as online learning (Allen & Seaman, 2013). The COVID-19 pandemic has accelerated higher education's trajectory toward virtual learning, forcing students and educators alike to adapt quickly to new

circumstances. Novel educational practices and settings, being forced upon many instructors and students alike, may be perceived as a threat by either party (Chick et al., 2020), making it important for instructors to continue to support autonomy, competence, and relatedness in their students. Future research is needed to examine whether there is an optimal amount of novelty. Perhaps too much or too little novelty can harm other psychological needs and student motivation (González-Cutre et al., 2016).

Lastly, the novel and not-so-novel effects of technology present themselves with many topics for further investigation. For example, experimental research on the use of mobile apps, digital textbooks, online courses, and other technologies (e.g., PowerPoint, Prezi, Quizlet) warrants examination to their long-term and even short-term effects on memory and motivation in students (e.g., Burke & James, 2008; Jenó, Vandvik, Eliassen, & Grytnes, 2019).

## **Conclusion**

We often forget as we age what it is like to learn something new. It can be easy for instructors to fall into a rhythm and have difficulty recognizing situations that warrant change (Lin, Schwartz, & Hatano, 2005). Although using new technology naturally incorporates novelty into the classroom, changing teaching practices may increase perceptions of novelty as well. Instructors who are skillful in delivering content with the intention of incorporating changes in the learning environment, such as using different physical spaces (Timken et al., 2019), adding hands-on activities (Ciarocco et al., 2013), or even changing the method of instruction (Jeno et al., 2019; Sandars et al., 2020) can evoke student perceptions of novelty. Instead of traditional lectures, we urge instructors to consider these three pedagogical points to improve classroom attention (Blouin et al., 2009; González-Cutre et al., 2016; Reber et al., 2018). First, reduce classroom time for simple transmission of factual information and attempt to change how this transmission is conducted, perhaps by scaffolding new information and activities on familiar information (Koops, 2017), using novel technology (Jeno et al., 2019), or breaking up lecture time with short new activities that focus on activation of prior knowledge, demonstration of tasks and skills, application of knowledge and skills in new tasks progressively, or integration of new skills in practice (e.g., a part-task approach; Sandars et al., 2020). Second, challenge students to think critically and communicate their ideas with real-world applications using current contexts that might not have been discussed in class before (e.g., pandemic, racial justice), as exemplified in discussions and applied in-class learning or demonstrations (Ciarocco et al., 2013). Finally, base the core values of the teaching philosophy on evidence-based education, while adjusting teaching practices with new tools that express those values (e.g., González-Cutre et al., 2016, 2020). These three areas could help instructors to keep incorporating novelty into the classroom that facilitates students' intrinsic motivation and learning outcomes, although further research is needed on the long-term effects of perceived novelty and what teaching practices or tools are considered more novel than others.

## **References**

- Allen, I. E., & Seaman, J. (2013). Changing course: Ten years of tracking online education in the United States. Retrieved from <https://www.onlinelearningsurvey.com/reports/changingcourse.pdf>
- Bagheri, L., & Milyavskaya, M. (2019). Novelty-variety as a candidate basic psychological need: New evidence across three studies. *Motivation and Emotion*. Advance online publication.

- Barto, A., Mirolli, M., & Baldassarre, G. (2013). Novelty or surprise? *Frontiers in Psychology*, 4, 907. 10.3389/fpsyg.2013.00907
- Bechkoff, J. (2019). Gamification using a choose-your-own adventure type platform to augment learning and facilitate student engagement in marketing education. *Journal for Advancement of Marketing Education*, 27, 13–30. Retrieved from <http://www.mmaglobal.org/publications/JAME/JAME-Issues/JAME-2019-Vol27-Issue1/JAME-2019-Vol27-Issue1-Bechkoff-pp13-30.pdf>
- Birdsell, B. (2018). Understanding students' psychological needs in an English learning context Brian Birdsell. *Journal of Liberal Arts Development and Practices*, 2, 1–14.
- Blouin, R. A., Riffée, W. H., Robinson, E. T., Beck, D. E., Green, C., Joyner, P. U., . . . Pollack, G. M. (2009). Roles of innovation in education delivery. *American Journal of Pharmaceutical Education*, 73, 154. Retrieved from [http://www.dh.gov.uk/prod\\_consum\\_dh/groups/dh\\_digitalassets/@dh/@en/documents/digitalasset/dh\\_088972.pdf](http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_088972.pdf)
- Burke, L. A., & James, K. E. (2008). Powerpoint-based lectures in business education: An empirical investigation of student-perceived novelty and effectiveness. *Business Communication Quarterly*, 71, 277–296. 10.1177/1080569908317151
- Carpenter, S. K., & Agarwal, P. K. (2019). How to use spaced retrieval practice to boost learning. Retrieved from <https://www.retrievalpractice.org/library>
- Chick, R. C., Clifton, G. T., Peace, K. M., Propper, B. W., Hale, D. F., Alseidi, A. A., & Vreeland, T. J. (2020). Using technology to maintain the education of residents during the COVID-19 pandemic. *Journal of Surgical Education*, 77, 729–732. 10.1016/j.jsurg.2020.03.018
- Ciarocco, N. J., Lewandowski, G. W., Jr., & Van Volkom, M. (2013). The impact of a multifaceted approach to teaching research methods on students' attitudes. *Teaching of Psychology*, 40, 20–25. 10.1177/0098628312465859
- Covill, L., & Cook, J. (2019). Comparison of academic performance in traditional and flipped classrooms and students' attitudes of the flipped experience. *Journal of Allied Health*, 48, e1–e7. Retrieved from <https://www.ingentaconnect.com/contentone/asahp/jah/2019/00000048/00000001/art00016#expand/collapse>
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York, NY: Plenum Press. 10.1007/978-1-4899-2271-7
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behaviour. *Psychological Inquiry*, 11, 227–268. 10.1207/S15327965PLI1104\_01
- De Jonge, K. M. M., Rietzschel, E. F., & Van Yperen, N. W. (2018). Stimulated by novelty? The role of psychological needs and perceived creativity. *Personality and Social Psychology Bulletin*, 44, 851–867. 10.1177/0146167217752361
- González-Cutre, D., Romero-Elías, M., Jiménez-Loaisa, A., Beltrán-Carrillo, V. J., & Hagger, M. S. (2020). Testing the need for novelty as a candidate need in basic psychological needs theory. *Motivation and Emotion*, 44, 295–314. 10.1007/s11031-019-09812-7



- González-Cutre, D., Sicilia, A., Sierra, A. C., Ferriz, R., & Hagger, M. S. (2016). Understanding the need for novelty from the perspective of self-determination theory. *Personality and Individual Differences*, 102, 159–169. 10.1016/j.paid.2016.06.036
- Grawe, N. (2018). Advancing the liberal arts in the face of demographic change. *Liberal Education*, 104. Retrieved from <https://www.aacu.org/liberaleducation/2018/fall/grawe>
- Harlow, L. L., Burkholder, G. J., & Jennifer, A. (2009). Evaluating attitudes, skill, and performance in a learning-enhanced quantitative methods course: A structural modeling approach. *Structural Equation Modeling*, 9, 37–41.
- Hartnett, J. (2020). Home. Retrieved from <http://notawfulandboring.blogspot.com/>
- Hastie, R. (1981). Schematic principles in human memory. In E. T. Higgins, C. P. Herman, & M. P. Zanna (Eds.), *Social cognition: The Ontario symposium on personality and social psychology* (pp. 39–88). Hillsdale, NJ: Erlbaum.
- Holton, D., & Clarke, D. (2006). Scaffolding and metacognition. *International Journal of Mathematical Education in Science and Technology*, 37, 127–143. 10.1080/00207390500285818
- Huang, C., & Gao, Z. (2013). Associations between students' situational interest, mastery experiences, and physical activity levels in an interactive dance game. *Psychology Health and Medicine*, 18, 233–241. 10.1080/13548506.2012.712703
- Jeno, L. M., Vandvik, V., Eliassen, S., & Grytnes, J. A. (2019). Testing the novelty effect of an m-learning tool on internalization and achievement: A self-determination theory approach. *Computers & Education*, 128, 398–413. 10.1016/j.compedu.2018.10.008
- Kagan, J. (1972). Motives and development. *Journal of Personality and Social Psychology*, 22, 51–66. 10.1037/h0032356
- Keller, J. M., & Suzuki, K. (2004). Learner motivation and E-learning design: A multinationally validated process. *Journal of Educational Media*, 29, 229–239. 10.1080/1358165042000283084
- Kenny, H. A. (2015). Teaching content area literacy in informal learning environments. *Forum on Public Policy Online*. Retrieved from <https://eric.ed.gov/?id=EJ1091519>
- Koops, L. H. (2017). The enjoyment cycle: A phenomenology of musical enjoyment of 4- to 7-year-olds during musical play. *Journal of Research in Music Education*, 65, 360–380. 10.1177/0022429417716921
- Koops, L. H. (2018). Classroom management for early childhood music settings. *General Music Today*, 31, 82–86. 10.1177/1048371318756997
- Lepper, M. R., Corpus, J. H., & Iyengar, S. S. (2005). Intrinsic and extrinsic motivational orientations in the classroom: Age differences and academic correlates. *Journal of Educational Psychology*, 97, 184–196. 10.1037/0022-0663.97.2.184
- Lin, X., Schwartz, D. L., & Hatano, G. (2005). Toward teachers' adaptive metacognition. *Educational Psychologist*, 40, 245–255. 10.1207/s15326985ep4004\_6

- Lubow, R. E., Rifkin, B., & Alek, M. (1976). The context effect: The relationship between stimulus preexposure and environmental preexposure determines subsequent learning. *Journal of Experimental Psychology*, 2, 38–47.
- Pavlov, I. P. (1927). *Conditional reflexes*. New York, NY: Oxford University Press.
- Piaget, J. (1969). *The psychology of intelligence*. Totowa, NJ: Littlefield, Adams.
- Plummer, B. D. (2019). *Toward more motivating classrooms: A study of the relationship between autonomy-supportive course design features and autonomous learner motivation* (Doctoral dissertation). Retrieved from <https://deepblue.lib.umich.edu/handle/2027.42/149962>
- Reber, R., Canning, E. A., & Harackiewicz, J. M. (2018). Personalized education to increase interest. *Current Directions in Psychological Science*, 27, 449–454. 10.1177/0963721418793140
- Rigby, C. S., & Ryan, R. M. (2017). Time well-spent? Motivation for entertainment media and its Eudaimonic aspects through the lens of self-determination theory. In L.Reinecke & M. B.Oliver (Eds.), *The Routledge handbook of media use and well-being: International perspectives on theory and research on positive media effects* (pp. 34–48). New York, NY: Routledge/Taylor & Francis Group.
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55, 68–78. 10.1037/0003-066X.55.1.68
- Ryan, R. M., & Rigby, C. S. (2019). Motivational foundations of game-based learning. In J. L.Plass, R. E.Mayer, & B. D.Homer (Eds.), *Handbook of game-based learning* (pp. 153–176). Cambridge, MA: The MIT Press.
- Sanchez, D. R., Langer, M., & Kaur, R. (2019). Gamification in the classroom: Examining the impact of gamified quizzes on student learning. *Computers & Education*, 144, 1–16.
- Sandars, J., Correia, R., Dankbaar, M., de Jong, P., Sun Goh, P., Hege, I., . . . Pusic, M. (2020). Twelve tips for rapidly migrating to online learning during the COVID-19 pandemic. *MedEdPublish*, 9, 1–14. 10.15694/mep.2020.000082.1
- Schomaker, J., & Meeter, M. (2015). Short- and long-lasting consequences of novelty, deviance and surprise on brain and cognition. *Neuroscience and Biobehavioral Reviews*, 55, 268–279. 10.1016/j.neubiorev.2015.05.002
- Schomaker, J., & Meeter, M. (2018). Predicting the unknown: Novelty processing depends on expectations. *Brain Research*, 1694, 140–148. 10.1016/j.brainres.2018.05.008
- Shapiro, D., Dundar, A., Huie, F., Wakhungu, P. K., Bhimdiwala, A., & Wilson, S. E. (2018). *Completing college: A national view of student completion rates—Fall 2012 cohort* (Signature report no. 16). Herndon, VA: National Student Clearinghouse Research Center.
- Sibold, J. (2016). Learning “A la carte”: A theory-based tool for maximizing student engagement. *Journal of College Teaching and Learning*, 13, 79–84. 10.19030/tlc.v13i2.9641
- Simons, K. D., & Klein, J. D. (2007). The impact of scaffolding and student achievement levels in a problem-based learning environment. *Instructional Science*, 35, 41–72. 10.1007/s11251-006-9002-5

- Son, J. Y., & Rivas, M. J. (2016). Designing clicker questions to stimulate transfer. *Scholarship of Teaching and Learning in Psychology*, 2, 193–207. 10.1037/stl0000065
- Stachowski, A. A., & Hamilton, K. L. (2019). Comparison of three “gamified” exam review activities. *Scholarship of Teaching and Learning*, 5, 312–318. 10.1037/stl0000154
- Swope, J. (2011, October, 13). 10 active learning activities to get psychology students out of their seats [Blog post]. Retrieved from <http://blog.sagrader.com/2011/10/13/10-active-learning-activities-to-get-psychology-students-out-of-their-seats/>
- Thomas, A. E., & Mueller, F. H. (2017). A magic dwells in each beginning? Contextual effects of autonomy support on students’ intrinsic motivation in unfamiliar situations. *Social Psychology of Education*, 20, 791–805. 10.1007/s11218-017-9393-y
- Timken, G., McNamee, J., & Coste, S. (2019). ‘It doesn’t seem like PE and I love it’: Adolescent girls’ views of a health club physical education approach. *European Physical Education Review*, 25, 109–124. 10.1177/1356336X17706382