Quantitative Investigation: Neuromyths, Knowledge About the Brain, Evidence-Based Practices, and Professional Development in Higher Education

Kristen Betts, Ed.D.
Drexel University, USA

Tamara Galoyan, Ph.D.
Massachusetts Institute of Technology, USA

Michelle Miller, Ph.D.
Northern Arizona University, USA

Brian Delaney, Ph.D.
Auburn University, USA

Mariette Fourie-Jardim, Ed.D.
University of the Western Cape, South Africa

Alida Anderson, Ph.D.
American University, USA

Tracey Tokuhama-Espinosa, Ph.D.
Harvard University Extension School, USA
Conexiones: The Learning Sciences Platform, Ecuador

Cynthia Borja, Ph.D.
The Decision Lab, Canada
Conexiones: The Learning Sciences Platform, Ecuador

Kurtulus Izzetoglu, Ph.D.
Drexel University, USA

Ellana Black
Drexel University, USA

Abstract
Shifting student demographics, evolving economic conditions, and the rapid advancement of artificial intelligence are prompting institutions to reconsider established pedagogical models and professional development. This study is the first phase of a two-year explanatory sequential mixed-methods project. A total of 303 individuals completed the survey, including instructors, instructional designers, and professional development administrators, representing primarily four-year and two-year institutions and other institutions such as health sciences centers, medical institutions, and online management programs. This study reports on participants' level of awareness of neuromyths, general knowledge about the brain, knowledge about the brain and learning, and evidence-based practices among instructors, instructional designers, and professional development administrators who worked across online, hybrid, HyFlex, and onsite modalities. The study compares mean percentages of accurate responses between groups and factors associated with awareness using Analysis of Variance (ANOVA) and post-hoc statistical tests. The study reports on strategies, principles, and practices used by participants to support learning. Additionally, the study reports on

participants' perceived value and interest in learning more about scientific knowledge about the brain. Although participants demonstrated high levels of awareness regarding the brain, knowledge about the brain and learning, and evidence-based practices, the results also revealed opportunities to increase awareness about neuromyths and scientific knowledge about the brain to support learning. This study provides critical insights into opportunities for enhanced awareness and transformative educational practices through professional development.

Keywords: Neuromyths, evidence-based practices, professional development, higher education, instructors, instructional designers

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The higher education landscape continues to shift in the United States (U.S.). Compounding factors have impacted enrollment patterns, including the looming enrollment cliff with projected decreases in college applications due to declining birth rates and demographic shifts (Hofman, 2025; Hoover, 2024; Marcus, 2025;), increasing questions about the value of a higher education degree (Merisotis, 2025; Mowreader, 2024), and high cost of tuition (Brown, 2025; Petersen, 2024; Wood, 2024). As further noted by Wartham (2025), "Institutions are now expected to be dynamic engines of workforce readiness—equipping learners with not just knowledge, but the agility and skills necessary to thrive in a world defined by continuous change" (para. 1). To address these challenges and support upskilling, reskilling, and career advancement, professional development for faculty and instructional designers is essential to support student engagement, increase retention, and prepare graduates to thrive in an increasingly complex global workforce.

Effective professional development is essential to the facilitation of effective teaching and learning experiences in contemporary higher education. One underlying factor is the historical lack of required pedagogical training since higher education faculty have disciplinary expertise and training in research, but may not have formal pedagogical preparation (Baker, 2024; Darling-Hammond, 2021; Gould & Hammond, 2021; Silander & Stigmar, 2021). Prior to the COVID-19 pandemic, professional development supported traditional on-campus programs and expanding online programs across higher education institutions (HEIs). During the pandemic, professional development became even more essential as courses quickly pivoted from on-campus learning to remote learning. To support the national shift in teaching modality, the United States federal government provided $39.6 billion in Higher Education Emergency Relief Funds (HEERF) to serve students and to ensure learning continued during the pandemic as instruction shifted online (United States Department of Education, 2023). After the initial shift to emergency remote instruction in early 2020, many HEIs continued to sustain their remote and hybrid learning infrastructure utilizing HEERF (Strietelmeier, 2023). Following the pandemic, HEIs have continued to offer professional development to support teaching and learning across modalities.

This study investigated professional development engagement of instructors, instructional designers, and professional development administrators working within four-year and two-year HEIs. Specifically, the study focused on the level of awareness of neuromyths, general knowledge about the brain, knowledge about the brain and learning, evidence-based practices, and interest in scientific knowledge about the brain to support learning.

Literature Review

The literature review begins by examining research studies on neuromyths, general knowledge about the brain and learning, and evidence-based practices. The literature review then explores professional development and its importance to teaching, learning, and retention.

Neuromyths

Neuromyths are false beliefs related to misconceptions, misunderstandings, or misinterpretations about the brain and brain function often associated with education and learning. Advancements in research and brain imaging technology have challenged these widespread beliefs about the brain and learning. Some of the most "classic" and prevalent neuromyths include: (a) some individuals are "left-brained" and some are "right-brained," and this helps explain differences in learning (OECD, 2002; Tokuhama-Espinosa, 2018); (b) individuals use only 10% of the brain (Bruer, 1997; OECD, 2007; Tokuhama-Espinosa, 2018); (c) it is best for children to learn their native language before a second language is learned (OECD, 2007; Tokuhama-Espinosa, 2018); (d) there are critical periods in human development after which certain skills can no longer be learned (Bruer, 1997; OECD, 2007; Tokuhama-Espinosa, 2018); (e) learning problems associated with developmental differences in brain function cannot be improved by education (Bruer, 1997; Goswami, 2006; OECD, 2007; Tokuhama-Espinosa, 2018); and (f) individuals learn better when they receive information in their preferred learning styles (OECD, 2007; Pashler et al., 2008; Riener & Willingham, 2010; Tokuhama-Espinosa, 2018; Weale, 2017).

The past three decades have seen increasing research on the awareness of neuromyths among educators. While most studies have been conducted within PK-12 education with pre-service and in-service teachers, increased research has been conducted in higher education. Within PK-12 education, studies have found that pre-service teachers and teachers benefit from initiatives aimed at enhancing neuroscience education literacy in both the initial education and continuous professional development (Bei et al., 2023; Jørgensen et al., 2023; McMahon et al., 2019).

Within higher education, there has been a growing number of related studies. Macdonald and colleagues (2017) examined endorsement of neuromyth beliefs in a U.S. sample of educators (n = 598), individuals with high neuroscience exposure (n = 234), and the general public (n = 3,045), analyzing predictors of individual differences in neuromyth endorsement. In their study, they found seven neuromyths that factored together (items on learning styles, dyslexia, the Mozart effect, the impact of sugar on attention, right-brain/left-brain learners, and using 10% of the brain). Their findings revealed that the general public endorsed the greatest number of neuromyths (M = 68%), followed by educators (M = 56%), and individuals with neuroscience exposure (M = 46%). Learning styles and dyslexia were the two most endorsed neuromyths across all groups. For example, the dyslexia myth of "seeing letters backwards" was endorsed at high rates among the public (M = 76%), educators (M = 59%), and even those with high neuroscience exposure (M = 50%). The study also indicated greater accuracy on neuromyths was predicted by (a) age (being younger), (b) education (having a graduate degree), (c) exposure to neuroscience courses, and (d) exposure to peer-reviewed science (Macdonald et al. 2017).

In 2018, the Online Learning Consortium conducted a study of higher education professionals, surveying 1,290 participants, including full-time instructors (33%), part-time instructors (13%), instructional designers (26%), professional development administrators (18%; n = 172), and other educational roles (10%) (Betts et al., 2019). Additional studies (Fragkaki et al., 2022; see reviews by Rousseau, 2021 and Torrijos-Muelas et al., 2021) have included higher education students and faculty. In these studies, the findings revealed an opportunity to increase the level of awareness regarding neuromyths to support student academic success. Understanding educator awareness of neuromyths in PK-12 education and higher education is important so professional development can share resources and training to address the persistence of neuromyths (Grospietsch & Mayer, 2020; Williams et al., 2025) and support evidence-based practices.

Researchers have called on future studies to address the impact of neuromyths on teaching practices and learner outcomes, and to focus on prevention strategies (Hughes et al., 2022; Taylor & Kowalski, 2023). Prevention strategies include refutational teaching (Guzzetti et al., 1993; Will et al., 2019), which involves the use of refutational texts and lectures to confront and correct misconceptions. This approach has been reported to lead to significantly reduced misconceptions in both science (Will et al., 2019) and psychology (Kowalski & Taylor, 2009; Taylor & Kowalski, 2012). For example, in the case of the dyslexia myth (backwards reading), refutational text strategies have been used to examine and address preservice teachers' concepts of dyslexia, finding that dyslexia knowledge could improve through reading refutation text as compared to control text (Peltier et al., 2020, 2022). Another strategy to prevent neuromyths involves the use of think-aloud protocols with students to better understand and address their sources of misconception, which supports instructors in utilizing refutational texts and lectures in teaching and learning contexts, as it has been established that misconceptions are more intractable than a lack of knowledge on a particular topic (Taylor & Kowalski, 2012). Other strategies include addressing the role of confidence in adherence to false beliefs, along with perceived sources of information in adherence to neuromyths (Hughes et al., 2022). Strategies for professional development include ensuring requisite topic depth and focus (i.e., to address conceptual change rather than myth adherence).

As the literature on neuromyths continues to grow (Betts 2019; Dekker et al., 2012; Geake, 2008; Macdonald et al., 2017; Pasquinelli, 2012; Bei et al., 2023; Tsang, 2024; Tunga & Çağıltay, 2023), researchers have identified that integrating insights from education, psychology, and neuroscience into professional development is an important strategy for increasing awareness and refuting neuromyths (Anderson, 2021; Mason, 2009; Pasquinelli, 2013). Researchers contend that scientifically based understandings are more likely to result in adoption and application to practice through bidirectional and ongoing coursework in educational neuroscience, such as in the case of dyslexia, by including neurocognitive and linguistic processes involved in reading development, as identified by advocates in the field (e.g., Consortium on Reading Excellence in Education, International Dyslexia Association) (Anderson, 2021).

General Knowledge about the Brain and Learning

There has been an increased focus on the integration of educational neuroscience into professional development (Chang et al., 2021; Dubinsky et al., 2013; Hachem et al., 2022; Pradeep et al., 2024; Tan & Amiel, 2019). Studies have examined the impact of professional development on general knowledge about the brain and learning, including basic neuroanatomical structures and functions (Chang et al., 2021), neuroplasticity (Dubinsky et al., 2013), and how factors like emotions, context, and attention can facilitate or inhibit knowledge acquisition. One of the key challenges of integrating educational neuroscience concepts into professional development for educators is helping non-neuroscientist educators make sense of complex neuroscience terms and processes. This applies to instructors at both the PK-12 and post-secondary levels. A study by Tan and Amiel (2019) found that instructional metaphors in K-12 professional development helped deepen teacher understanding of educational neuroscience concepts when applied in practice. Hachem and colleagues (2022) designed and delivered a year-long professional development program in partnership with a high school in Western Canada. Teachers involved in the program described how neuroscience knowledge acquired during professional development training helped improve their relationships with students over time. Cui and Zhang (2021) surveyed K-12 teachers (n=214) and found that neuroscience professional development was correlated with a higher knowledge of neuroscience concepts.

A separate study of higher education instructors by Chang and colleagues (2021) followed up with participants one year after they completed a three-week course that emphasized foundational ideas in educational neuroscience. The authors found that participants perceived all educational neuroscience concepts introduced in the course to be relevant, and multiple concepts actively served as guiding principles in pedagogy and instructional design. Notably, the study focused on participant implementation of educational neuroscience concepts and did not measure student outcomes (Chang et al., 2021, p. 13). The increasing number of studies exploring the impact of professional development aimed at strengthening instructors' awareness and/or praxis of concepts grounded in cognitive psychology, education, and neuroscience reflects the continuing efforts to bridge the gap between educational research and practice.

Evidence-Based Practices

Buskist and Groccia (2011) define evidence-based teaching as "the conscientious, explicit, and judicious integration of best available research on teaching technique and expertise within the context of student, teacher, department, college, university, and community characteristics" (p. 8). They offer example practices such as formative assessment/quizzing for mastery, alternating short periods of lecture with in-class active learning exercises, and team projects involving applied or realistic problem solving (Buskist & Groccia, 2011; also see Jakobsen & Daniel, 2019). A wide variety of benefits of these kinds of practices have been documented within higher education classrooms, including improvements to grades, reduction of disparities affecting less advantaged and minoritized students (Pennebaker et al., 2013; Penner et al., 2021), and even reduced anxiety among students (Cooper et al., 2018).

Evidence-based practices are dynamic and continuously evolve through research and new discoveries. Recent research, for example, has strengthened the understanding of the effectiveness of retrieval practice or retrieval-based learning, meaning answering test questions (as one would do with a low-stakes quiz over assigned reading, for example) as part of the learning or study process (Butler & Roediger, 2007; Carpenter et al., 2022; Dunlosky & O'Brien, 2022; Karpicke & Roediger, 2008; Miller, 2011; Yang et al., 2023). Spacing of study is another core practice for building knowledge quickly; this well-established principle holds that study sessions increase in effectiveness as they are more widely spaced in time, even when the total amount of study time remains constant (Carpenter et al., 2022; Feenstra et al., 2024; Carpenter et al., 2012; Dunlosky & O'Brien, 2022).

Evidence-based practices may not always be obvious or intuitive to faculty. Even those who are interested in innovation may lack the training or background knowledge to select instructional techniques backed by research, as well as the time to read extensively within the field of learning sciences (Lovett et al., 2023; Wynants & Dennis, 2018). It follows that deliberate cultivation of knowledge and skill in evidence-based teaching is needed for most faculty, along with supports to make this feasible to accomplish given constraints on faculty time. In contemporary institutions of higher education, professional development is a critical mechanism for developing and disseminating evidence-based teaching practices. Teaching and learning centers are places where faculty can both learn about the relevant research and gain guidance about how to put it into practice in their own classes (Lovett et al., 2023). Leaders of these centers, along with associated professionals such as instructional designers, therefore, have an important role to play in identifying, disseminating, and implementing evidence-based practice throughout a campus.

Professional Development

Professional development is defined as "structured professional learning that results in changes in teacher practices and improvements in student learning outcomes" (Darling-Hammond et al., 2017, p. v). Professional development includes, but is not limited to, onboarding, workshops, webinars, bootcamps, and certificate programs. Prior to the pandemic, many HEIs offered professional development on campus. However, the higher education landscape quickly shifted during the pandemic. By mid-April 2020, "192 countries had closed all schools and universities, affecting more than 90 percent of the world's learners" (Psacharopoulos et al., 2020, para. 1). As HEIs closed, professional development moved to online, hybrid, and HyFlex formats to ensure learning continued throughout the pandemic.

The impact of the pandemic on higher education enrollments was profound. Nationally, undergraduate enrollments dropped approximately 8% from 2019 to 2022, with continued declines even after HEIs returned to in-person classes (Binkley, 2023; Shapiro, 2023). Although undergraduate enrollments in fall 2023 grew for the first time since the beginning of the pandemic, the sudden and prolonged decreases in enrollments due to the pandemic greatly impacted many institutions (National Student Clearing House, 2024). Since March 2020, "at least 83 public and nonprofit colleges have closed, merged, or announced closures or mergers" (Castillo & Welding, 2025, para. 1). In December 2024, the Federal Reserve Bank of Philadelphia issued a report predicting that up to 80 colleges may close in the next five years with the upcoming demographic cliff (Kelchen et al., 2025). In September 2025, it was reported that hundreds of U.S. colleges could be poised to close in the next decade (Rembert & Albright, 2025).

In this challenging landscape, professional development for faculty and instructional designers is more important than ever for HEIs to support and retain the students they enroll, now across multiple modalities. Research studies have frequently documented relationships between teaching quality and student retention across postsecondary contexts (Arce et al., 2015; Mestan, 2016; Qvortrup & Lykkegaard, 2022), among other non-teaching factors. Effective professional development can improve teaching quality (Fabriz et al., 2020; Gore et al., 2017), though impact varies considerably. When professional development programming is ineffective, this may reflect issues related to program duration, insufficient administrative support for integration of new knowledge, or a lack of alignment with classroom needs (Zhou et al., 2025). Sims et al. (2025) propose that effective professional development succeeds through a combination of four components: it develops teacher insights, motivates change, facilitates the development of techniques, and supports the integration of those techniques in practice. The integration of translational research from neuroscience, psychology, and education provides new insight that builds upon evidence-based practices for teaching and supports the transfer of learning. Studies using brain imaging techniques exploring the human learning process further support evidence-based practices while debunking classical neuromyths, such as using just 10% of the brain, being right or left-brained, and visual-auditory-kinesthetic learning styles (Betts et al., 2019). By leveraging research from neuroscience, psychology, and education in professional development offerings, faculty and instructional designers can participate in training that supports teaching, learning, and assessment across all course modalities to support student engagement, retention, and completion.

Despite the growing body of research on neuromyths and evidence-based practices, most studies have centered on PK–12 contexts, with comparatively fewer focusing on higher education faculty, instructional designers, and professional development administrators. Moreover, while awareness of neuromyths and the application of learning sciences are increasing, persistent misconceptions and uneven implementation of evidence-based strategies suggest critical gaps in knowledge translation and professional development. To address these gaps, the present study builds on prior research by examining the awareness levels, practices, and professional learning interests of key stakeholders in higher education.

The Present Study

This study is the first phase of a two-year international explanatory sequential mixed-methods research project. The first part of this project was a quantitative study designed to examine the awareness of neuromyths, general knowledge about the brain, knowledge about the brain and learning, and evidence-based practices among instructors, instructional designers, and professional development administrators who work across online, hybrid, HyFlex, and onsite modalities. The second part of this project, which was informed by this study, was a qualitative study that included focus groups with the data being reported in a separate article.

This comprehensive quantitative study builds upon prior research conducted on neuromyths and evidence-based practices through the Online Learning Consortium (Betts et al., 2019) as well as other national and international studies (Dekker et al., 2012; Dündar & Gündüz, 2016; Fragkaki et al., 2022; Macdonald et al., 2017). Additionally, this study provides new insight into the types of strategies, principles, and practices being applied to support learning and what instructors, instructional designers, and professional development administrators would like to learn more about. The data collected from this study were used to support the questions designed for the second phase of this mixed-methods study that explored professional development attended post-pandemic.

Four research questions guided this study.

> What was the level of awareness of neuromyths, general knowledge about the brain, knowledge about the brain and learning, and evidence-based practices among professional roles (instructor, instructional designer, professional development administrator)
>
> Were there statistically significant differences between instructors, instructional designers, and professional development administrators in awareness of neuromyths, general knowledge about the brain, knowledge about the brain and learning, and evidence-based practices?
>
> What types of strategies, principles, and practices did instructors, instructional designers, and professional development administrators apply to support learning?
>
> To what extent was there interest in instructors, instructional designers and professional development administrators in scientific knowledge about the brain?

Method

Research Design and Participants

The instrument used for this study builds upon the prior survey used in 2018 for an Online Learning Consortium (OLC) international study (Betts et al., 2019). Small changes were made to the 2018 study for greater consistency with wording, such as using third-person pronouns and not mixing second- and third-person pronouns throughout. There were five sections for this study: (a) General Statements about the Brain; (b) General Statements about Teaching, Learning, and Assessment; (c) Instructional Practices; (d) Professional Development; and (e) Demographics and Professional Background. For the first two sections, participants were provided with a list of statements from which they selected three choices: *correct*, *incorrect*, and *unsure*. The third section provided a detailed list of evidence-based instructional strategies, principles, and practices that support learning. Participants were asked to identify whether they were familiar with them and how they learned about them. The fourth section asked participants about the types of professional development they attended during the pandemic. Additionally, they were asked about their interest in scientific knowledge about the brain and whether they found it to be valuable to their teaching practice, course development, and professional development. The fifth section asked questions regarding the participants' role (instructor, instructional designer, professional development administrator, other) and the type of institution in which they taught, with the location of the institution. Additional information was asked regarding the types of courses taught or designed prior to the pandemic, course format preference for teaching and instructional design, gender, highest degree completed, and whether they completed the 2018 OLC survey.

Convenience and snowball sampling were used for this study. Survey collection occurred between October 2021 and January 2022. An invitation was sent through the OLC listserv inviting members to complete an online survey and to share the invitation with others who were in the roles of instructor, instructional designer, and administrator responsible for professional development. The OLC sent out the first invitation with one email reminder. Members of the research team also shared the email invitation with peers at HEIs nationally and internationally. Recipients were asked to forward the invitation to other eligible participants. Because the survey invitation was disseminated through multiple channels and sharing was at the discretion of the recipients, a response rate could not be calculated.

This study was approved by the Institutional Review Board (IRB) at Drexel University. The invitation included a description of the study, definitions, and an embedded link to the Qualtrics survey site. Participants had to give informed consent before completing the survey. Statistical Package for the Social Sciences (SPSS for Windows, ver. 29) was used to analyze the data. Frequencies and cross-tabulations were used to present descriptive data. Inferential statistics included one-way Analysis of Variance (ANOVA) for multiple comparison tests to evaluate differences among the three professional groups (instructor, instructional designer, professional development administrator) on mean for percent accurate responses to questions about neuromyths, general statements about the brain, and knowledge about the brain and learning ([# of correct responses to 27 questions / 27] * 100%). One-way ANOVA was also used to evaluate differences among the three professional groups on mean for percent accurate responses to questions about evidence-based practices ([# of correct responses to 23 questions / 23] * 100%). For all statistical analyses, the level of significance was set at $\alpha = 0.05$. Post-hoc analysis using the Bonferroni test was conducted to examine the differences in the mean scores between the groups. The Cronbach's alpha coefficient was .711 for the 27 neuromyths, general statements about the brain, and knowledge about the brain and learning items, and .614 for the 23 evidence-based practices items, which revealed an acceptable level of internal consistency.

Participants

A total of 303 individuals participated in the study and completed the survey. All participants provided informed consent. Of the participants, approximately half were instructors (49%), including full-time and part-time instructors. Thirty-three percent were instructional designers, and 18% were professional development administrators. Most participants (71%) worked in four-year institutions while 17% worked in two-year institutions and 12% worked in other types of institutions of which some of the responses included a health sciences center, medical institution, and online management program. Fifty-nine percent of the participants worked at public institutions followed by private institutions (35%), for-profit institutions (3%), and other types (3%) of which only four responses were listed including the federal government, military, non-profit, and military graduation institution. Participants reported they were currently teaching and engaged in course development across undergraduate programs, graduate programs, and professional certificates/certification programs. The data revealed that 25% of participants taught across multiple types of programs while 39% were engaged in course development across multiple types of programs. Of the participants, 21% shared that they did not teach while 12% did not develop courses.

Fourteen percent of participants completed the 2018 OLC survey that examined neuromyths, general knowledge about the brain, and evidence-based practices. Table 1 includes data regarding role, institution (level, type), and teaching and course development experience.

Table 1

Role, Type of Institution, and Experience

Role	*n*	*%*
Instructor (faculty, lecturer, professor) full-time (n=104) part-time (n=42)	146	49
Instructional designer	97	33
Administrator (PD)	54	18
Total	297	100
Institution: Level	*n*	*%*
2-Year institution	50	17
4-Year institution	209	71
Other	35	12
Total	294	100
Institution: Type	*n*	*%*
Public	174	59
Private	105	35
For-profit	8	3
Other	9	3
Total	296	100
Teaching Across Programs	*n*	*%*
Only associate’s degree	28	9.3
Only bachelor’s degree	65	21.7
Only graduate (master’s, doctoral) degree	40	13.3
Only professional certificates/certifications	9	3.0

Associate and bachelor's degrees	12	4.0
Associate and graduate degrees	2	.7
Associate degree and professional certificate/certifications	4	1.3
Associate, bachelor's, and graduate degrees	5	1.7
Associate, bachelor's, and professional certificate/certifications	2	.7
Bachelor's and graduate degrees	23	7.7
Bachelor's and certificate/certifications	2	.7
Bachelor's, graduate degree, and professional certificate/certifications	14	4.7
Graduate degree and professional certificate/certifications	11	3.7
Other	21	7.0
I don't teach	62	20.7
Total	300	100.0
Course Development Across Programs	*n*	*%*
Only associate's degree	31	10.3
Only bachelor's degree	51	17.0
Only graduate (master's, doctoral) degree	34	11.3
Only professional certificates/certifications	19	6.3
Associate and bachelor's degrees	6	2.0
Associate and graduate degrees	2	.7
Associate's degree and professional certificate/certifications	2	.7
Associate, bachelor's, and graduate degrees	7	2.3
Associate's, bachelor's, and professional certificate/certifications	2	.7
Associate, graduate, and professional certificate/certifications	2	.7
Associate, bachelor's, and professional certificate/certifications	12	4.0
Bachelor's and graduate degrees	37	12.3
Bachelor's and certificate/certifications	4	1.3
Bachelor's, graduate degree, and professional certificate/certifications	28	9.3
Graduate degree and professional certificate/certifications	16	5.3
Other	10	3.3
I don't develop courses	37	12.3
Total	300	100.0

Most participants self-identified as female (71%). Twenty-five percent self-identified as male, 1% self-identified as non-binary, and 3% chose not to respond. The age of participants at the time of the survey showed that most were between the ages of 45 to 54 years old (29.8%), 55 to 64 years old (26.6%), and 35 to 44 years old (23.2%). The highest degree completed by participants were doctorate degree (46.3%) including PhD (35%) and EdD (11.3%) followed by master's degree (44%). Table 2 includes a breakdown of demographics.

Table 2

Demographics

Gender	*n*	*%*
Female	212	71
Male	74	25
Non-binary	2	1

I choose not to respond	11	3
Total	299	100
Age at Time of Survey	*n*	%
18 to 24 years	2	0.7
25 to 34 years	31	10.7
35 to 44 years	67	23.2
45 to 54 years	86	29.8
55 to 64 years	77	26.6
65 years or older	21	7.3
I choose not to respond	5	1.7
Total	289	100
Highest Degree Completed	*n*	%
Bachelor's degree	4	1.3
Completed some postgraduate	2	0.7
Master's degree	132	44
PhD (Doctor of Philosophy)	105	35
EdD (Doctor of Education)	34	11.4
DBA (Doctor of Business) Administration	4	1.3
JD (Juris Doctor)	2	0.7
MD (Doctor of Medicine)	1	0.3
Other	16	5.3
Total	300	100

Participants represented 22 countries across six continents including North America, Europe, Asia, the Middle East, Africa, and Oceania. Of US participants, a total of 43 states and Washington, DC were represented. Table 3 includes a breakdown of the countries in which the participants' institution was located.

Participants were asked to rank their level of preference in modalities for teaching and instructional design with 1 being the most preferred to 4 being the least preferred. Online was selected by Instructional Designers and Professional Development Administrators as their preferred teaching modality while Instructors selected Onsite (see Table 3). All three groups selected Online as their preferred instructional design modality (see Table 4).

Table 3

Ranked Level of Preference in Modalities for Teaching

Participant Group	Modality	*M*	*SD*
Instructors	Onsite	1.95	1.053
	Online	2.15	1.062
	Hybrid	2.46	0.862
	HyFlex	3.44	0.852
Instructional designers	Online	1.62	0.956
	Hybrid	2.25	0.830
	Onsite	2.74	1.066
	HyFlex	3.39	0.790

Professional development administrators	Online	1.82	1.023
	Onsite	2.31	1.080
	Hybrid	2.36	0.873
	HyFlex	3.51	0.756

Table 4

Rank Level of Preference in Modalities for Instructional Design

Participant Group	Modality	*M*	*SD*
Instructors	Online	1.91	0.952
	Onsite	1.96	1.020
	Hybrid	2.58	0.853
	HyFlex	3.55	0.782
Instructional designers	Online	1.32	0.610
	Hybrid	2.30	0.822
	Onsite	3.08	0.940
	HyFlex	3.30	0.822
Professional development administrators	Online	1.56	0.923
	Hybrid	2.39	0.891
	Onsite	2.59	1.095
	HyFlex	3.46	0.636

Results

The results of the study are presented in response to the four research questions.

Awareness of Neuromyths, General Knowledge about the Brain, Knowledge about the Brain and Learning, and Evidence-Based Practices among Professional Roles

Tables 5-8 present the results of the cross-tabulation analysis reporting on the percentage of accurate responses related to neuromyths, general knowledge about the brain, knowledge about the brain and learning, and evidence-based practices, broken down by participants' role. The tables also provide the answer key for each statement. For example, as shown in Table 5, lower percentages for accurate responses for the incorrect statement "A common sign of dyslexia is seeing letters backwards" were found among all three groups, including instructors (22%), instructional designers (7%), and administrators (28%). Similarly, lower percentages for accurate responses for the incorrect statement "Listening to classical music increases reasoning ability" were found among instructors (23%), instructional designers (21%), and administrators (24%). There were two statements in which there were greater differences in accurate responses by group. Instructional designers were found to have higher levels of awareness of the following two incorrect statements: "Individuals learn better when they receive information in their preferred learning styles (e.g., auditory, visual, kinesthetic)" (instructors, 38%; instructional designers, 64%; administrators, 46%), and "Some individuals are 'left-brained' and some are 'right-brained,' and this helps explain differences in learning" (instructors, 45%; instructional designers, 69%; administrators, 61%). Higher percentages for accurate responses were found across all groups for the incorrect statement "Learning problems associated with developmental differences in brain function cannot be improved by education" (instructors, 84%; instructional designers, 81%; and administrators 85%).

Table 5

Percentage of Accurate Responses for Statements about Neuromyths by Role

Statement	Instructors (full-time, part-time)	Instructional Designers	Administrator (PD)	Answer Key
	%	%	%	
Listening to classical music increases reasoning ability	23	21	24	Incorrect
A common sign of dyslexia is seeing letters backwards	22	7	28	Incorrect
Individuals learn better when they receive information in their preferred learning styles (e.g., auditory, visual, kinesthetic)	38	64	46	Incorrect
Some individuals are "left- brained" and some are "right-brained," and this helps explain differences in learning	45	69	61	Incorrect
Humans use only 10% of their brain	62	66	69	Incorrect
It is best for children to learn their native language before a second language is learned	66	70	70	Incorrect
There are critical periods in human development after which certain skills can no longer be learned	74	77	83	Incorrect
Learning problems associated with developmental differences in brain function cannot be improved by education	84	81	85	Incorrect

Table 6 shows a high percentage of accurate responses for several statements within general knowledge about the brain among all three groups. For example, 95% of instructors, 99% of instructional designers, and 94% of administrators provided accurate responses for the incorrect statement "The brain shuts down during sleep." Similarly, 93% of instructors, 96% of instructional designers, and 94% of administrators provided accurate responses for the correct statement "Production of new neuronal connections in the brain continues over the lifespan." By contrast, lower percentages of accurate responses were observed for the incorrect statement "The brain is a muscle," with 52% of instructors, 45% of instructional designers, and 57% of administrators providing accurate responses.

Table 6

Percentage of Accurate Responses for Statements about General Knowledge about the Brain by Role

Statement	Instructors (full-time, part-time)	Instructional Designers	Administrators (PD)	Answer Key
	%	%	%	
The brain is a muscle	52	45	57	Incorrect
Normal brain development involves the birth and death of brain cells	69	72	74	Correct
Human brains are relatively as unique as fingerprints	73	77	89	Correct
When a brain region is damaged, other parts of the brain can sometimes take up its function	85	85	83	Correct
The left and right hemispheres of the brain work together	89	89	94	Correct
Neuroplasticity is the brain's ability to reorganize and rewire itself over the lifespan	91	90	85	Correct
Individuals use their brains 24 hours a day	93	98	91	Correct
Production of new neuronal connections in the brain continues over the lifespan	93	96	94	Correct
Chronic stress can change brain structure	93	92	96	Correct
Brain development has finished by the time children reach puberty	93	93	94	Incorrect
The brain shuts down during sleep	95	99	94	Incorrect

As to knowledge about the brain and learning, Table 7 shows a high percentage of accurate responses for several statements. For example, for the correct statement “Learning physically changes the brain,” 94% of instructors, 91% of instructional designers, and 82% of administrators provided accurate responses. Similarly, for the incorrect statement “Intelligence is fixed at birth,” 92% of instructors, 96% of instructional designers, and 94% of administrators provided accurate responses. By contrast, lower percentages of accurate responses were reported for the incorrect statement “Learning is due to the addition of new cells to the brain” by instructors (49%), instructional designers (63%), and administrators (46%).

Table 7

Percentage of Accurate Responses for Statements about Knowledge about the Brain and Learning by Role

Statement	Instructors (full-time, part-time)	Instructional Designers	Administrators (PD)	Answer Key
	%	%	%	
Learning is due to the addition of new cells to the brain	49	63	46	Incorrect
The brain acts as a filter to help individuals focus their attention	67	58	76	Correct
Individual learners show preferences for the mode in which they receive information (e.g., auditory, visual, kinesthetic)	79	78	83	Correct
Information is stored in networks of cells distributed throughout the brain	82	79	82	Correct
Extended practice of some mental processes can change the shape and structure of some parts of the brain	84	81	82	Correct
Learning occurs when there are changes to the connections between brain cells	88	77	78	Correct
Intelligence is fixed at birth	92	96	94	Incorrect
Learning physically changes the brain	94	91	82	Correct

As shown in Table 8, participants demonstrated high levels of knowledge of various evidence-based practices. For example, 97% of instructors, 98% of instructional designers, and 100% of administrators provided accurate responses for the correct statement “Emotions can affect human cognitive processes, including attention, learning and memory, reasoning, and problem-solving.” Similarly, 98% of all three groups provided accurate responses for the correct statement “Meaningful feedback accelerates learning” while 97% of instructors, 99% of instructional designers, and 98% of administrators provided accurate responses for the correct statement “Sleep has a vital role in memory.” By contrast, lower percentages of accurate responses were recorded for the incorrect statement “Differentiated instruction is individualized instruction” and the correct statement “Critical thinking requires epistemic cognition.” Specifically, only 38% of instructors, 50% of instructional designers, and 52% of administrators provided accurate responses for the incorrect statement about differentiated instruction. Similarly, only 36% of instructors, 39% of instructional designers, and 44% of administrators provided accurate responses for the correct statement about critical thinking.

Table 8

Percentage of Accurate Reponses for Statements About Evidenced-Based Practices by Role

Statement	Instructors (full-time, part-time) %	Instructional Designers %	Administrator (PD) %	Answer Key
Differentiated instruction is individualized instruction	38	50	52	Incorrect
Critical thinking requires epistemic cognition	36	39	44	Correct
Focused attention is essential for learning new information	63	62	43	Correct
Testing, in general, tends to detract from learning	68	59	54	Incorrect
Experts and novices approach solving problems in essentially the same way	73	84	78	Incorrect
The human brain seeks and often quickly detects novelty	74	80	78	Correct
Rereading course materials is the best strategy for learning	75	83	78	Incorrect
Human memory works much like a digital recording device or video camera in that it accurately records the events individuals have experienced	78	84	72	Incorrect
Multitasking increases productivity	78	86	82	Incorrect
With respect to memory, massed instruction is superior to spaced instruction	80	92	83	Incorrect
Universal Design for Learning is a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn	81	93	89	Correct
Frequent, low stakes assessments do not enhance learning	84	96	87	Incorrect
One is either born creative or not; creativity cannot be taught	86	94	96	Incorrect
Spaced studying of information is remembered better than massed studying of the same information	88	92	78	Correct
Metacognition plays a role in learning	94	97	96	Correct
Explaining the purpose of a learning activity helps engage students in that activity	94	99	98	Correct

The mind connects new information to prior knowledge	97	98	91	Correct
Repeated practice and rehearsal of learned material or a skill helps to consolidate it in long-term memory	97	95	96	Correct
Sleep has a vital role in memory consolidation	97	99	98	Correct
Emotions can affect human cognitive processes, including attention, learning and memory, reasoning, and problem-solving	97	98	100	Correct
Maintaining a positive environment in the classroom helps to promote learning	98	95	93	Correct
Stress can impair the ability of the brain to encode and recall memories	98	96	96	Correct
Meaningful feedback accelerates learning	98	98	98	Correct

Mean Percentage of Accurate Responses: Neuromyths, Knowledge About the Brain, and Knowledge About the Brain and Learning

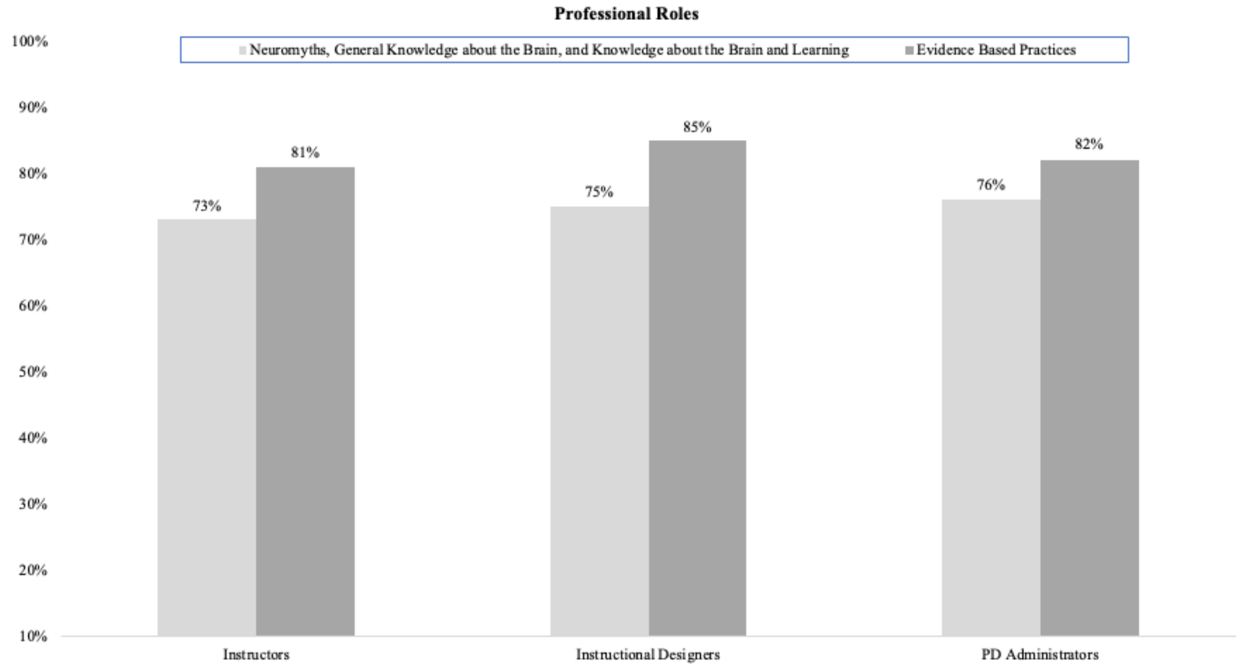
A total of 27 statements examined neuromyths, general knowledge about the brain, and knowledge about the brain and learning. Inferential statistics, including ANOVA and post-hoc analysis, were used to compare the mean percentage of accurate responses. The data revealed that professional development administrators (M = 76) had a higher mean percentage of accurate responses on neuromyths, general information about the brain, and the knowledge of the brain and learning than instructional designers (M = 75) and instructors (M = 73; see Figure 1); however, the analysis of variance did not indicate any statistically significant differences between groups (F = .867, p = .421). There were also no statistically significant differences indicated between groups and institution type (public, private, for-profit) or institution level (two-year, four-year, other), and the percentage of accurate responses on neuromyths, general knowledge about the brain, and knowledge of the brain and learning. Additional analyses revealed no statistically significant differences between groups and demographic categories (full-time and part-time employment, highest degree earned, time from highest degree earned, age, and gender), and the percentage of accurate responses on neuromyths, general knowledge about the brain, and knowledge of the brain and learning.

Mean Percentage of Accurate Responses: Evidence-Based Practices

A total of 23 statements were brought together to examine evidence-based practices. Inferential statistics including ANOVA and post-hoc analysis were used to compare the mean percentage of accurate responses. The analysis of variance indicated a statistically significant difference between groups (F = 4.642, p = .010) and the percentage of accurate responses on evidence-based practices. Instructional designers (M = 85) had a higher mean percentage of accurate responses on evidence-based practices than administrators (M = 82) and instructors (M = 81; see Figure 1). Post-hoc analysis using the Bonferroni method indicated a statistically significant difference between instructional designers and instructors (p = .011) while there were no statistically significant differences between instructional designers and administrators or between instructors and administrators. There were no statistically significant differences found between groups and institution type (public, private, for-profit) or institution level (two-year, four-year, other) in awareness of evidence-based practices. Additional analyses revealed no statistically significant differences between groups and demographic categories (full-time and part-time employment, highest degree earned, time from highest degree earned, age, and gender) in the mean percentage of accurate responses on evidence-based practices.

Figure 1

Professional Role: Mean Percentage of Accurate Responses for Neuromyths, General Knowledge About the Brain, and Knowledge of the Brain and Learning, and Evidence-Based Practices Statements



Reading Journals and Mean Percentage of Accurate Responses

Participants who read journals related to neuroscience, psychology, learning sciences, and Mind, Brain, and Education (MBE) Science had a higher mean percentage of accurate responses on neuromyths, general knowledge about the brain, and knowledge about the brain and learning than participants who did not read or who planned to read these types of journals. An analysis of variance indicated statistically significant differences between groups who read, did not read, and planned to read journals related to neuroscience ($F = 8.898$, $p = .001$), psychology ($F = 7.200$, $p = .001$), learning sciences ($F = 9.931$, $p = .001$) and MBE Science ($F = 14.312$, $p = .001$). Post-hoc analysis using the Bonferroni method indicated a statistically significant difference between participants who read and participants who did not read and between participants who read and planned to read journals focused on neuroscience, psychology, learning sciences, and MBE Science. No significant difference was indicated between participants who did not read and participants who planned to read journals focused on neuroscience, psychology, learning sciences, and MBE science (see Table 9).

Table 9

Post-Hoc Analysis: Journals Related to Neuroscience, Psychology, Learning Sciences, and Mind, Brain and Education Science

	Neuroscience Journals	Psychology Journals	Learning Sciences Journals	MBE Science Journals
Read vs. Do Not Read	p = .001	p = .007	p = .004	p = .001
Read vs. Plan to Read	p = .001	p = .005	p = .001	p = .001
Do Not Read vs. Plan to Read	p = .581	p = .561	p = .567	p = .910

Note: p < .05

Participants who read journals related to neuroscience, psychology, learning sciences, and MBE Science had a higher mean percentage of accurate responses on evidence-based practices than participants who did not read or planned to read these types of journals (see Figure 3). An analysis of variance indicated statistically significant differences between groups with participants who read, who did not read, and who planned to read journals related to psychology (F = 3.312, p = 0.038) and MBE Science (F = 3.927, p = 0.021), and awareness of evidence-based practices. There were no statistically significant differences indicated between groups who read, did not read, or planned to read journals related to neuroscience (F = 1.294, p = 0.276) or the learning sciences (F = 2.630, p = 0.074) and awareness of evidence-based practices. Post-hoc analysis using the Bonferroni method indicated no statistically significant difference between participants who read and participants who did not read (p = 0.051), between participants who read and planned to read (p = 0.247), and between participants who do not read and plan to read (p = 1.000) journals focused on psychology. A statistically significant difference was indicated between participants who read and who did not read (p = 0.019) journals focused on MBE science. No statistically significant difference was found between participants who read and planned to read and between participants who did not read and planned to read journals focused on MBE science.

Figure 2

Reading Journals: Mean Percentage of Accurate Responses for Neuromyth, General Knowledge about the Brain, Knowledge of the Brain, and Learning Statements

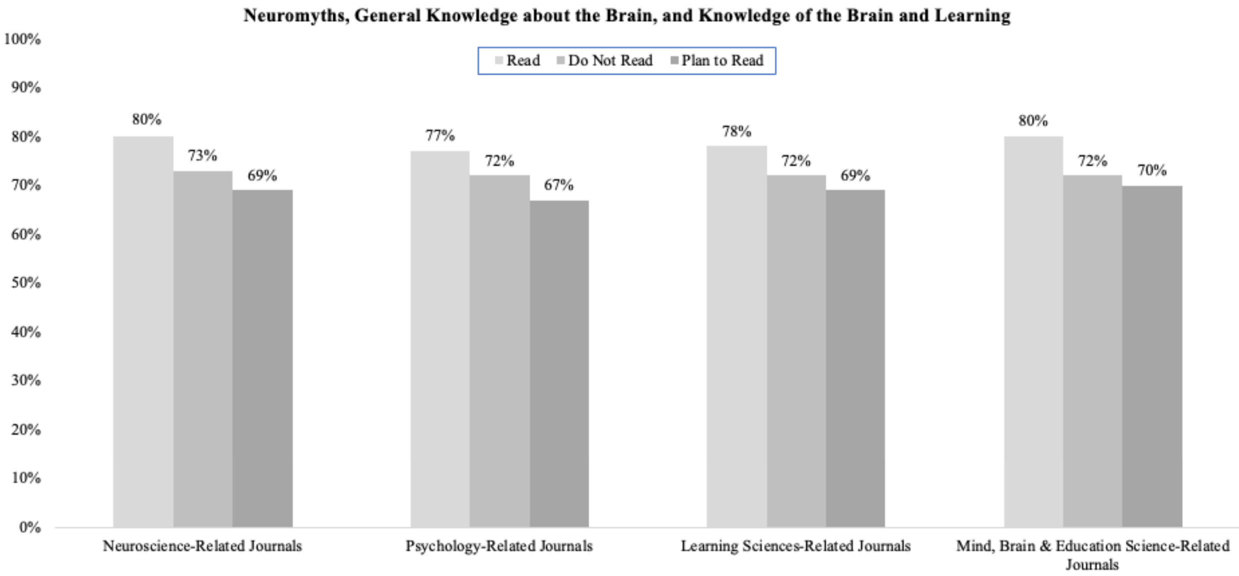
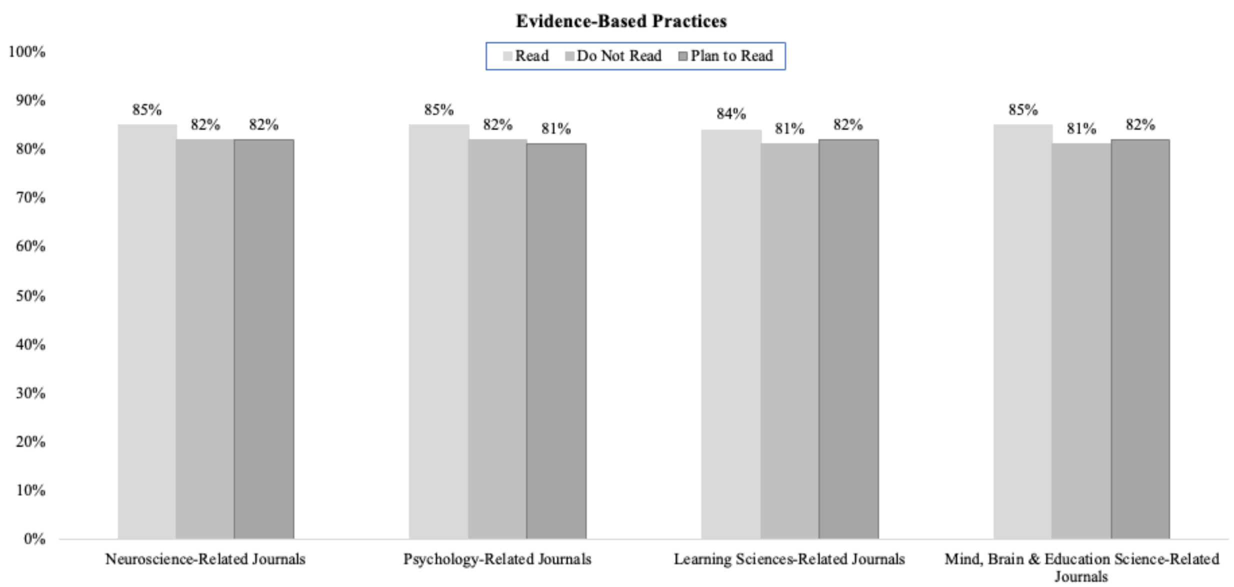


Figure 3

Reading Journals: Mean Percentage of Accurate Responses for Evidence-based Practice Statements



Strategies, Principles, and Practices to Support Learning

Table 10 presents the results of the descriptive statistical analysis reporting on the percentage of responses related to participants' use of, and familiarity with, various strategies, principles, and practices to support learning. Participants were asked to identify out of a list of 29 strategies, principles, or practices that they were currently using, had used in the past, were familiar with but had not yet used, and were unfamiliar with. The five strategies, principles, and practices used most by participants included Active Learning (82%), Scaffolding (77%), Low Stakes Assessment (75%), Backward Design (66%), and Project Based Learning (65%). It should be noted that approximately one-third of participants indicated they were teaching to students' learning styles (32%) and approximately one-third indicated they used to teach to students' learning styles (32%). The data also indicated that 12% of participants were teaching to right- and left-brain characteristics to support learning.

Table 10

Use of Strategies, Principles, and Practices to Support Learning

	Currently use	Have used in the past	Familiar with but not yet used	Unfamiliar with this
	%	%	%	%
Active learning	82	11	4	3
Scaffolding	77	13	3	7
Low stakes assessment	75	13	5	7
Backward design	66	12	10	12
Project-based learning	65	17	14	4
Metacognition	65	10	15	10
Universal design for learning	64	12	12	12
Experiential learning	62	17	17	4
Promoting growth mindset	60	10	18	12
Coaching	57	15	18	10
Elaboration	55	11	5	29
Spaced practice	52	16	14	18
Culturally responsive teaching	52	10	24	14
Cognitive load theory	53	9	13	25
Retrieval practice	51	19	9	21
High stakes assessment	49	34	10	7
Differentiated instruction	45	21	17	17
Mindfulness	43	10	35	12

Social-emotional learning	41	11	25	23
Multisensory learning	39	20	22	19
Creativity and innovation integration	37	11	14	38
Articulation	36	8	11	45
Interleaved practice	23	11	13	53
Task interspersal	23	5	14	58
Arts integration	21	15	26	38
Massed practice	19	23	21	37
Epistemic cognition	18	5	12	65
Teaching to students' learning styles	32	32	32	4
Teaching to right-brain and left-brain characteristics	13	11	50	26

Participants were asked to identify when and all of the ways in which they had learned about the 29 different strategies, principles, and practices, ranging from high school to graduate education and professional development to the Internet. Tables 11 and 12 report on the percentage of responses related to the ways in which participants had learned about the different strategies, principles, and practices. The data indicate that over one-third of participants learned about many evidence-based practices during their graduate education and during professional development prior to the pandemic, such as active learning, backward design, project-based learning, experiential learning, and low-stakes assessments, among others. It should also be noted that neuromyths such as teaching to learning styles or to right/left brain characteristics were identified as having higher percentages of participants having learned about them during graduate education and professional development during the pandemic, as well as through the Internet.

Table 11

Ways in Which Participants Learned About Strategies, Principles, and Practices

	During my high school education	During my undergraduate education	During my graduate education	Colleagues	Online / Internet (e.g., content, blogs, podcasts, etc.)	Books	Articles
	%	%	%	%	%	%	%
Active Learning	8	17	44	30	32	25	32
Articulation	2	7	20	9	7	6	8
Arts Integration	4	11	18	11	12	7	10
Backward Design	2	7	34	29	30	25	26
Coaching	7	14	31	25	23	15	21
Cognitive Load Theory	2	6	31	18	20	16	21
Creativity & Innovation Integration	4	8	24	15	14	10	13
Culturally Responsive Teaching	1	7	25	30	34	21	28
Differentiated Instruction	5	15	32	23	27	22	26
Elaboration	8	19	29	12	15	14	14
Epistemic Cognition	2	5	13	5	7	5	7
Experiential Learning	5	17	39	30	24	15	24
High Stakes Assessment	19	24	38	19	17	17	17
Interleaved Practice	2	7	14	8	15	14	11
	During my high school education	During my under-graduate education	During my graduate education	Colleagues	Online / Internet (e.g., content, blogs, podcasts, etc.)	Books	Articles
	%	%	%	%	%	%	%
Low Stakes Assessment	8	18	39	26	27	23	25
Massed Practice	16	20	18	8	9	10	8
Metacognition	4	14	36	24	29	20	26
Mindfulness	1	7	19	24	24	15	20
Multisensory Learning	3	12	29	11	17	11	15
Project Based Learning	5	14	40	28	26	16	26
Promoting Growth Mindset	3	7	29	29	31	22	26

Retrieval Practice	21	24	30	15	22	23	21
Scaffolding	5	16	45	29	28	22	29
Social Emotional Learning	3	9	29	17	19	12	17
Spaced Practice	7	15	26	12	22	19	16
Task Interspersal	2	4	17	7	9	5	7
Universal Design for Learning	2	5	28	32	35	25	31
Teaching to right-brain and left-brain characteristics	8	13	16	7	14	8	8
Teaching to students' learning styles	8	18	36	18	23	16	19

Table 12

Additional Ways in Which Participants Learned About Strategies, Principles, and Practices

	PD prior to Pandemic	PD during the Pandemic	OLC Workshops	Unsure	N/A
	%	%	%	%	%
Active Learning	45	24	11	2	1
Articulation	15	8	3	8	12
Arts Integration	11	5	2	9	12
Backward Design	40	19	8	3	2
Coaching	31	16	4	7	4
Cognitive Load Theory	23	13	6	6	6
Creativity & Innovation Integration	19	9	4	6	10
Culturally Responsive Teaching	32	30	12	4	3
Differentiated Instruction	34	16	9	7	6
Elaboration	19	9	7	8	10
Epistemic Cognition	7	5	1	8	18
Experiential Learning	38	17	8	3	2
High Stakes Assessment	29	10	5	6	2
Interleaved Practice	16	9	5	6	16

	PD prior to Pandemic	PD during the Pandemic	OLC Workshops	Unsure	N/A
	%	%	%	%	%
Low Stakes Assessment	38	19	9	3	1
Massed Practice	11	6	5	10	13
Metacognition	33	17	8	4	4
Mindfulness	28	19	5	4	6
Multisensory Learning	21	9	6	8	9
Project Based Learning	41	17	7	2	2
Promoting Growth Mindset	35	20	8	4	4
Retrieval Practice	32	12	8	8	7
Scaffolding	42	20	8	2	1
Social Emotional Learning	28	14	5	5	7
Spaced Practice	27	15	7	8	7
Task Interspersal	12	4	2	7	17
Universal Design for Learning	42	26	15	3	3
Teaching to right-brain and left-brain characteristics	11	4	3	7	13
Teaching to students' learning styles	31	10	6	4	5

Participants were also asked which of the 29 listed practices, strategies, and principles on the survey they would like to learn more about. The list below reports on the top ten most frequently mentioned practices, strategies, and principles. Approximately one-third of all participants indicated they wanted to learn more about epistemic cognition, while roughly one-quarter wanted to learn more about task interspersal, interleaved practice, articulation, and creativity and innovation integration. Around one fifth of the participants wanted to learn more about cognitive load theory, culturally responsive teaching, elaboration, Universal Design for Learning, and social emotional learning.

1. Epistemic Cognition (32.3%)
2. Task Interspersal (27.7%)
3. Interleaved Practice (26.1%)
4. Articulation (23.8%)
5. Creativity and Innovation Integration (23.1%)
6. Arts Integration (21.1%)
7. Cognitive Load Theory (19.8%)

8. Culturally Responsive Teaching (19.1%)
9. Elaboration (18.8%)
10. Universal Design for Learning (17.8%) and Social Emotional Learning (17.8%)

Interest in Scientific Knowledge About the Brain

The study revealed that the participants found high value in scientific knowledge about the brain and its influence on learning and were also highly interested in learning more (see Table 13). In particular, most participants strongly agreed and agreed that scientific knowledge about the brain is valuable for their teaching practice (94%), course development (96%), and professional development (94%). Furthermore, 95% of the participants strongly agreed or agreed they were interested in learning more about the scientific knowledge about the brain and its influence on learning.

Table 13

Percentage of Responses for Statements About Value of and Interest in Scientific Knowledge About the Brain

	Valid Percent Strongly Disagree/ Disagree	Valid Percent % Strongly Agree/Agree	Not Applicable
	%	%	%
I find scientific knowledge about the brain and its influence on learning valuable for my teaching practice	3	94	3
I find scientific knowledge about the brain and its influence on learning valuable for course development	3	96	1
I find scientific knowledge about the brain and its influence on learning valuable for professional development	4	94	2
I am interested in learning more about the brain and its influence on learning	4	95	1

Limitations

This study has two key limitations. First, the study used convenience and snowball sampling. This may have led to a biased sample and underrepresentation since participants were invited based on accessibility and connections to the OLC and the research team. The second limitation is reduced response rates. When the survey was sent, higher education institutions across the United States shut for a second time due to the pandemic. Courses that had moved on campus quickly moved again to an online format. This shift may have impacted participant availability to complete the survey.

Discussion

The findings revealed that misconceptions such as dyslexia being associated with seeing letters backwards and the belief that classical music enhances reasoning ability remain prevalent across instructors, instructional designers, and administrators, with no statistically significant differences between role groups. These results confirm prior studies showing that deeply ingrained neuromyths continue to persist despite widespread educational efforts to debunk them (Newton, 2020; Tardif et al., 2015). The persistence of such beliefs is problematic because they can lead to misinformed instructional practices and may reinforce misconceptions about students with learning differences (Dekker et al., 2012). Notably, instructional designers showed comparatively higher degrees of awareness of two particularly pernicious neuromyths (Macdonald et al., 2017): teaching to learning styles and left/right-brain differences. Over half of full-time and part-time instructors indicated belief in those two neuromyths, and most professional development administrators believed the learning styles myth. These results point to a considerable knowledge gap, the presence of which further supports the need for targeted professional development that strengthens neuromyth awareness across all educator groups.

It should be noted that many of the findings related to neuromyths were similar to the findings from studies conducted with K-12 teachers nationally and internationally. While participants in this study worked in higher education, there were similar misconceptions regarding dyslexia as seeing letters backwards, music enhancing reasoning ability, individuals learning better when they receive information in their preferred learning style, or differences in learning being associated with being left-brained and right-brained (Bei et al., 2023; Tsang, 2024; Dekker et al., 2012; Ruiz-Martin et al., 2022; Simmers & Davidesco, 2024; Tunga & Çağıltay, 2023; van Dijk & Lane, 2018). The prevalence of these misconceptions within K-12 education and higher education reveals an opportunity to address persistent myths through professional development grounded in the learning sciences.

Encouragingly, high levels of accurate responses were observed for general brain knowledge and evidence-based practices, including the recognition that learning physically changes the brain, neuroplasticity continues across the lifespan, and emotions and feedback strongly influence learning outcomes. These findings align with a growing body of literature highlighting that educators are increasingly aware of neuroscience-informed principles that support effective pedagogy, such as the benefits of spaced practice, metacognition, and formative feedback (Corral & Carpenter, 2025; Dunlosky et al., 2013; Fleur et al, 2021; Wisniewski et al. 2020). However, the relatively low awareness of statements such as critical thinking requires epistemic cognition (correct) and differentiated instruction is individualized instruction (incorrect) reveals important gaps between general awareness and deep knowledge of evidence-based strategies. While educators may be familiar with broad cognitive and affective principles, they may struggle with translating these into complex instructional frameworks. Increasing awareness of critical thinking and epistemic cognition (Lunn Brownlee et al. 2022; Tarchi et al., 2025; Tamayo Alzate, 2025), as well as differentiated instruction (Liou et al., 2023; Pozas et al., 2021) can support pedagogical practice. Furthermore, translating the learning sciences into practice (Norman & Lotrecchiano, 2021) and neuroscience findings to classroom practices (Justus et al., 2024) can increase educator knowledge regarding research-informed practices.

The results indicated no statistically significant differences across professional roles, institution type, or demographic variables in accurate responses to neuromyths, general knowledge about the brain, or knowledge about the brain and learning. This suggests that misconceptions about the brain and learning are not confined to particular professional or institutional groups. Prior research similarly shows that neuromyths persist across diverse educator populations, including teachers, instructional leaders, and faculty in higher education (Dekker et al., 2012; Newton, 2020). The finding that professional development administrators had slightly higher mean scores for accurate responses, though not statistically significant, may reflect their greater exposure to professional learning contexts. These patterns highlight the challenge of dispelling neuromyths through traditional pathways of professional development and emphasize the need to seek innovative approaches to embed neuroscience literacy explicitly into professional development programs (Dubinsky et al., 2013; Jolles & Jolles, 2021; Simmers & Davidesco, 2024) and professional learning communities (Justus et al., 2024).

In contrast, significant differences emerged in participants' knowledge of evidence-based practices, with instructional designers scoring higher than instructors. This finding aligns with Stefaniak and colleagues (2025), who report that instructional designers are often expected to incorporate evidence-based principles, pedagogical theory, and design research in their practice. Instructional designers, often trained in pedagogy and learning design, may have greater opportunities to engage with educational theory and research than instructors whose training may be more discipline specific (Wynants & Dennis, 2018). Given that effective teaching requires a solid grasp of how learning occurs, these findings call for intentional cross-role collaboration and the creation of shared learning experiences in professional development settings. As Newcombe (2023) emphasized, faculty must make detailed decisions about how they implement instructional and study strategies. Thus, professional development should be dynamic, data-informed, and inclusive of emerging practices such as spaced practice, retrieval-based learning, and cognitive load theory (Carpenter et al., 2022; Feenstra et al., 2024). Embedding these practices institutionally can build a more cohesive and scientifically grounded educational culture across all modalities of teaching and learning.

Another interesting finding is that participants who reported regularly reading journals in neuroscience, psychology, learning sciences, and MBE science consistently demonstrated higher accuracy in identifying both correct knowledge and evidence-based practices. This supports research showing that engagement with scholarly literature fosters critical evaluation skills and decreases susceptibility to neuromyths (Dekker et al., 2012; Rousseau, 2021; Seccia & Allee, 2024). These findings reinforce calls for professional development that integrates current scientific literature and provides structured opportunities for educators to critically appraise research claims. As noted by Lovett et al. (2023), cultivating a culture of data-informed teaching through access to scholarly resources can close the gap between research and practice.

The findings indicate that participants reported high levels of use of evidence-based instructional practices such as active learning (82%), scaffolding (77%), low-stakes assessment (75%), backward design (66%), project-based learning (65%), and metacognition (65%). These results are consistent with the broader literature emphasizing that these strategies enhance student engagement, promote deeper learning, and support knowledge transfer (Freeman et al., 2014; Park & Xu, 2024). The prevalent use of these practices by participants in this study could indicate that educators are increasingly adopting approaches grounded in the learning sciences, aligning with calls to move beyond traditional, lecture-centric teaching toward active, student-centered pedagogy. The prominence of backward design and project-based learning also highlights a possible shift toward intentional course alignment and authentic, inquiry-based learning experiences, both of which are strongly supported in higher education contexts (Thomas, 2020). That said, recent research has found that didactic methods remain the predominant pedagogical choice for instructors in undergraduate STEM classrooms (Jackson et al., 2022), even when barriers like high course enrollment, inflexible learning spaces, and introductory-level courses were reduced or removed (Stains et al., 2018). Stains and his 30 co-authors called for institutions to overhaul tenure and promotion policies that instead incentivize, assess, and reward evidence-based instruction. Such a change would require increased investment in professional development programming to effectively train higher education's teaching force on evidence-based practices and neuromyth awareness in applicable contexts.

At the same time, the findings from this study reveal that a substantial proportion of participants continue to report using neuromyth-based practices. Approximately one-third of respondents indicated they currently teach to learning styles (32%), with another third reporting that they had used this approach in the past (32%), and 12% reported teaching to right- or left-brain characteristics. These findings echo previous research demonstrating the persistence of neuromyths among educators, even in the face of strong empirical evidence refuting their validity (Dekker et al., 2012; Newton, 2020). The continued use of learning styles is particularly concerning as it may take educators' time and resources away from implementing more effective, evidence-based strategies such as retrieval practice and spaced learning (Dunlosky et al., 2013). The fact that many participants reported first encountering neuromyths in graduate education, professional development during the pandemic, or online highlights how misinformation can circulate through both formal and informal learning channels, emphasizing the importance of critical engagement with scientific literature (Macdonald et al., 2017).

The significant interest expressed by participants in learning more about the brain and its influence on learning aligns with recent findings on the value of educational neuroscience in professional development. As Chang et al. (2021) and Hachem et al. (2022) note, educators who engage with neuroscience-informed professional learning report enhanced pedagogical insight and deeper understanding of student learning processes. In this study, nearly all participants agreed that brain-based knowledge is valuable for teaching, course development, and professional growth. This reinforces the potential of integrating translational research into ongoing faculty development initiatives. Moreover, the survey constructs examining knowledge about the brain, learning, and evidence-based practices are supported by studies such as Dubinsky et al. (2013) and Tan and Amiel (2019), which highlight the need for professional development that integrates neuroscience concepts for educators and connects them directly to classroom practice.

With growing demand for more flexible course delivery options (Coffey, 2023) and decreasing perceived value of college degrees (Kaplan, 2023; Lederman, 2023), course design and delivery have become critical in meeting the needs of students and preparing them for an increasingly competitive global workforce. Participants expressed a preference for online professional development, which can provide more accessible, flexible opportunities to engage with new research. Online professional development can be critical in providing faculty and instructional designers with new opportunities to learn about evidence-based practices based on scientific knowledge and transdisciplinary research from neuroscience, psychology, and education. Strengthening instructional quality by helping instructors ground their pedagogy in evidence-based practices can increase educational effectiveness.

Professional development must begin by addressing and dispelling persistent myths about how learning works, since misconceptions can undermine effective practice. Once these myths are replaced with accurate, research-based understandings that are grounded in psychology, neuroscience, and education, professional development can then introduce and reinforce evidence-based principles that guide effective teaching and learning strategies, thus providing a sustainable pathway to enhance instructional quality and, in turn, improve student outcomes in higher education.

As HEIs continue to traverse an increasingly dynamic and evolving educational landscape, it is imperative that administrators continually reassess their professional development strategy. Educators are encouraged to explore their disciplinary identities, contemplating what constitutes knowing in their disciplines; how this shapes curricular, pedagogic, and assessment choices; and what implications these questions have on teaching and learning. For example, we can explicate the chain of reactions when a university writing instructor comprehends the ramifications of the learning styles myth for the first time at a professional development workshop. They will quickly evaluate which of their teaching practices may have been influenced by the (now-debunked) belief that instructors should customize teaching to a student’s stated learning style. They will recall past conversations about learning styles with students, parents, and colleagues. Motivated to seek alternative approaches supported by research, the instructor will then discover the merits of differentiated instruction versus individualized instruction. This new knowledge might later be shared with colleagues in the Writing department, sparking spirited discussions that culminate in collaborative revisions to instruction at both the micro and macro levels. The department collects internal evaluation data to help assess the implementation and impact of those revised instructional practices, which strengthens the department’s self-study report for reaccreditation and future pursuits for additional professional development funds. In this way, the professional development experience extends beyond the concept of training into a catalyst for transformative teaching and learning change that supports student and institutional success.

Recommendations

Based on this study, there are three recommendations to support teaching and learning in higher education. Each recommendation emphasizes the importance of aligning practice with research from the learning sciences to prepare graduates for an increasingly complex global workforce.

Ground Teaching in Evidence-Based Practices

The Hippocratic Oath in Medicine reminds physicians to protect patients and to do no harm. Similarly, educators should follow suit in their approach to instructional design and teaching, ensuring that educational practices are grounded in research rather than false assumptions. Evidence-based practices are needed to support the foundations of an individual’s thinking abilities, and consequently, society’s democratic foundations. Furthermore, evidence-based teaching will help to bridge the gap between scientific research and practice while helping educators justify their instructional approaches and continuously improve them in response to the changing needs of diverse students.

Stay Current

Professional development needs in higher education reflect global trends toward a demand for constant upskilling and reskilling to keep pace with continually advancing fields.

A broader range of students and a narrowing number of applicants have forced HEIs to rethink the skill sets required of those designing and providing teaching and learning experiences. Independent of the teaching-learning modality (e.g., online, hybrid, onsite, or HyFlex), better knowledge of how and why the brain learns needs to become common knowledge for professional educators. Explicit instruction, implicit reinforcement, and updating about neuromyths should be a part of both initial formation as well as continual professional development. Additionally, engaging with scientific literature is crucial for educators because it keeps their knowledge current and grounded in the latest research on teaching, learning, and human development. By actively reading peer-reviewed articles, educators can critically evaluate which instructional approaches are supported by evidence, identify emerging trends, and avoid relying on outdated or untested methods.

Continuous Professional Growth

The value of a higher education degree depends on its ability to prepare students for the future along with learning from the past. Educators with antiquated understandings or unsubstantiated beliefs about how the brain learns will quickly lose credibility with advancements in research, the ubiquity of artificial intelligence, and the accessibility of digital learning tools. Continuous professional growth requires intentional institutional support, including opportunities to engage in instructional training, learning communities, mentorship, and collaborative professional networks. By providing professional development opportunities that integrate the latest learning sciences research and encourage educators to engage in innovation, reflection, and refinement of practice, HEIs can foster a culture of continuous growth that strengthens teaching quality and sustains institutional relevance.

To remain relevant in the coming decades, HEIs must adapt by both learning from the past and embracing the latest research and technologies of today. Unlike K-12 education in which teachers receive extensive pre-service training, most professors enter higher education with little formal preparation, learning to teach by drawing on their own student experiences and trial-and-error teaching (Newcombe, 2023). Educators must ground teaching in evidence-based practices, stay current, and engage in continuous professional growth. Ultimately, HEIs need to empower educators with the time, resources, and professional development to prepare graduates to thrive in a dynamic, competitive, and ever-evolving global workforce.

Conclusions

The results of the study indicate high levels of awareness with evidence-based practices among all participants. The results also revealed opportunities to increase levels of awareness regarding neuromyths, general knowledge about the brain, and knowledge about the brain and learning. There are some areas of knowledge that continue to lag, especially with respect to learning styles and the idea of left-brained/right-brained learners. Notably, the research indicates a strong interest among instructors, instructional designers, and administrators in gaining scientific knowledge about the brain and its impact on learning. Moreover, all three groups recognize the value of such knowledge in teaching, course development, and professional growth.

As HEIs navigate the integration of AI into curricula, professional development will be critical as well to supporting strategies, principles, and practices that support learning. This study suggests that professional development serves as a unique platform for HEIs to disseminate current and emerging research through workshops, seminars, and certificate programs that bring together educators, instructional designers, and administrators.

Professional development and exposure to transdisciplinary research and resources can enhance awareness of neuromyths, general knowledge about the brain and learning, and evidence-based practices. Finally, this study contributes to understanding the importance of integrating research from neuroscience, psychology, and education into professional development offerings so faculty and instructional designers can utilize this scientific-based knowledge within their course development, teaching, and assessment across all course modalities to support student and institutional success.

Declarations

Conflict of Interest

The authors conducted the research under strict ethical standard. They declare no conflicts of interest and received no external funding.

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