**Building Research Ecosystems and a Culture of Inquiry**

Wai Meng YAP (waimeng.yap@help.edu.my)

HELP University, Kuala Lumpur

Elaine F. FERNANDEZ (elaine.fernandez87@gmail.com)

HELP University, Kuala Lumpur

**Abstract**

Scientific thinking is an approach to thinking that follows the scientific method of observation, testing, and falsification. Yet, there is uncertainty and a lack of research on which approaches are best suited for developing this skill among undergraduate students. Based on a review of the literature, it is argued that research methods courses play an essential role towards enhancing scientific thinking skills in undergraduate students. This can be achieved by following four key principles: (1) acknowledging psychosocial barriers to research methods learning; (2) using problem-based approaches to teaching research; (3) combining both didactic and student-led approaches to learning and (4) using technology to augment the teaching and learning of research methods and scientific thinking. A case study of the Bachelor of Psychology program from the Department of Psychology, HELP University, is used to detail how these principles are put into practice across its curriculum.

***Keywords***: Scientific Thinking, Research Ecosystem, Culture of Inquiry, Pseudoscience, Research Methods Teaching, Problem-based Learning, Department of Psychology

**Introduction**

In this chapter, the authors review the need for developing scientific thinking in undergraduate students. It is argued that scientific thinking skills are necessary in allowing students to adapt to, and make informed decisions in a volatile, uncertain, complex, and ambiguous world. Scientific thinking is also argued for its importance in relation to the proliferation of fake news and pseudoscientific claims – both of which may lead to misinformation and possibly harmful decisions. The authors then argue that the teaching and learning of research methods courses – particularly within the psychological sciences, is ideally placed to help undergraduate students develop scientific thinking skills and to counter the tendency to believe in non-scientific claims. A review of the literature on effective teaching and learning of scientific methods follows, with recommendations then suggested based on a case study of the Department of Psychology at HELP University.

**Background**

**Science as a Candle in the Dark**

Effective tertiary education learning outcomes typically aim to equip its candidates with the necessary skills and capabilities that serve two overarching aims: (1) enhance their employability, and (2) encourage a life-long orientation towards continuous learning and improvement. To this end, both undergraduate and postgraduate programs identify, and incorporate as part of their curricula, key transferable skills – one of which is scientific thinking. Scientific thinking is defined by Koerber and colleagues (2015) as, "the ability to generate, test, and evaluate claims in ways that minimize inherent propensities towards bias." Importantly, the scientific endeavor is undergirded by key philosophical assumptions about the nature of human understanding and knowledge. Science expositor Carl Sagan (1995) argues, however, that science is more than just a body of knowledge. Rather, science is an epistemic approach towards evidence that focuses on error reduction. Scientific knowledge is derived from careful, repeated, and replicable observation and/or experimentation, which results in an understanding of our natural and social worlds that can be placed on a continuum of certainty and confidence. A quote by physicist Richard Feynman captures the essence of scientific inquiry: "Scientific knowledge is a body of statements of varying degrees of certainty – some most unsure, some nearly sure – none absolutely certain." (Millman, 2011, p.3)

The acknowledgment of the importance of integrating such a mindset, and more generally, a scientific attitude in education is not new. Schmaltz and Lilienfeld (2017), in a recent editorial in Frontiers in Psychology stress that the importance of scientific thinking is even more crucial today, in an era where "even legitimate news organizations at times promote invalid or misleading information (p.820)." Further, the need for effective science education is made even more essential, given the presence of dubious, invalid, and even dangerous misconceptions about our physical and social realities. Misinformation and misconceptions about issues such as climate change and the effects of vaccination, for instance, suggest a lack of science-based thinking. Climate change deniers and anti-vaccination advocates show a clear preference for either the supernatural or the subjective over data and facts derived from rigorous observation and studies. Schmaltz and Lilienfeld (2017) add that individuals supporting these non-science positions do so based on political affiliation – which tends to be more emotional than rational in nature.

**Scientific Thinking in Psychology: Evidence-Based vs. Pseudoscience**

One area of study in which scientific thinking is particularly important is the psychological sciences. Psychology, as a scientific study of cognitive, affective (i.e. emotional), and behavioral processes, is a comparatively new domain within the social sciences. In contrast with disciplines such as physics, biology, or chemistry, psychology's history can be traced back to as recently as a little over a century ago, when physician Wilhelm Wundt established the first dedicated psychology laboratory in Leipzig, Germany in 1879 (Ash,1980). Psychology has also established a presence within the Asian region. While the discipline is generally recognized and acknowledged as a branch of scientific inquiry, practical applications of the discipline – particularly in the treatment of mental disorders and enhancement of psychological well-being, are still hampered by strong social stigmas. Reviews of research within this area highlight how certain Asian populations are more likely to prioritize folk, supernatural, religious, or magical treatments for mental health issues (Abdullah & Brown, 2011; Lauber & Rössler, 2007). The adverse consequences brought about by mental health interventions that are not scientific or evidence-based can be damaging and downright harmful.

Further adding to these challenges is the proliferation of pseudoscientific approaches to mental health. Pseudoscience, in this regard, refers to claims, statements, or 'knowledge' which purports to follow scientific principles but can be distinguished from legitimate science in at least three criteria. First, pseudoscience claims to position itself and links itself to domains of science. Second, and crucially, however, such claims generally suffer from a severe lack of credibility. The claimed findings are unreliable, and proponents are often defensive or resistant to evidence that suggests the contrary. Third, pseudoscience claims often attempt to create the impression that it represents the most reliable body of knowledge on a given subject matter (Hansson, 2013). Examples of pseudoscience include graphology (the study of personality traits and characteristics through handwriting Ben-Shakhar et al. 1986); blood type personality (Rogers & Glendon, 2003; Cramer & Imaike, 2002), and more recently, neuro-linguistic programming (NLP) (Witkowski, 2010) and Eye Movement Desensitization and Reprocessing (EMDR) (Davidson & Parker, 2001). All these practices have been scientifically invalidated. Unfortunately, misinformation about the validity and efficacy of these treatments remains, again, in part due to the general lack of skepticism and scientific approach to assessing these pseudoscientific claims.

**Research: The Language of Science**

The scientific endeavor relies on rigorous and careful observation and experimentation. Even when assertions and claims are drawn from the results of any scientific investigation, these conclusions are often presented as tentative, accompanied by an acknowledgment of the limitations of the current study and suggestions for how researchers can further advance research within that area. The cultivation of scientific thinking then, is largely reliant on understanding, evaluating, and summarizing scientific communications in the form of scientific research reports. Research and scientific thinking are heavily intertwined – scientific knowledge advances in increments and is tentative. Research methods (and to some extent statistics courses) in universities may thus play this crucial role in advancing scientific thinking ability in undergraduates. Indeed, there is evidence to suggest that incorporating the ability to think scientifically into research modules can serve to both increase skills related to analyzing arguments (Bensley et al. 2010) and decrease learner's paranormal and pseudoscientific beliefs (Stark, 2012). Universities the world over have, to varying degrees, attempted to incorporate the principles of scientific thinking into their psychology curricula – particularly within their research methods and statistics courses.

**Main focus of the chapter**

**Building Research Systems and a Culture of Inquiry**

In this chapter, the authors highlight some of the research in this area, to answer the overarching question, "What are some of the best approaches and strategies, in the teaching of research methods that can enhance students' ability to think scientifically?" The authors then offer evidence-based suggestions in the following two sections of the chapter: the first focusing on teaching and learning principles within large-scale (lecture) and small-scale (tutorial) settings and the second focusing on the creation of a culture of inquiry – that is, a culture of learning based around openness to new ideas, questions, and dialogue between teachers and learners. In short, the authors distinguish between strategies that can be adopted within the course itself and between/across courses. Both categories of strategies work in tandem, however, and in the service of creating a research ecosystem that enhances scientific thinking skills in students.

**Teaching Students Scientific Thinking through Research Methods Courses**

In this section, four key principles that can be applied to the teaching of specific research methods courses are highlighted. While the majority of our reviewed and cited literature focuses on the teaching of research within psychology, the authors contend that the principles here may also apply to the teaching of research methods courses and the cultivation of scientific thinking skills across different disciplines within the social sciences – business, economics, or sociology, for instance. The four principles are: (1) acknowledge psychosocial barriers to research methods learning; (2) use problem-based approaches to teaching research; employ both formative and summative assessments; (3) combine both didactic and student-led approaches to learning and (4) use technology to augment the teaching and learning of research methods and scientific thinking.

*Acknowledge Psychosocial Barriers to Research Methods Learning*

A commonly-mentioned theme – and barrier, in the teaching of research methods and scientific thinking, is students' general view of research methods (and statistics) as being technical, complex, or downright daunting. Indeed, educational research has long established the existence of statistics and math anxiety (Macher et al. 2012; Onwuegbuzie & Wilson, 2003) as having adverse consequences on student learning, and performance in research methods and statistics courses. At least one study has also shown a significant correlation between both forms of anxiety (Zeidner, 1991). For most undergraduate students commencing their studies in psychology, such anxiety can detract from their overall learning experience, and instead spur unproductive behaviors such as procrastination and reluctance to seek assistance in understanding the course content (Onwuegbuzie, 2004). An additional barrier that has been highlighted by several researchers – and notably, using samples from an Asian context, is the reluctance to directly engage with peers, query, or present challenging questions to the course instructor (Hussain et al. 2007). These cultural contexts and norms moderate the extent to which students are likely to engage with or speak up in the learning environment.

The combination of both anxiety towards a complex and technical subject matter, and restrictive assumptions about the learning environment are impediments to effective learning of research methods. Researchers have also proposed approaches to overcome these barriers. Pan and Tang (2004; 2005) for instance, highlight the importance of instructor attentiveness, coupled with application-oriented teaching methods – and show that combining these approaches was effective in reducing statistics anxiety in their samples of social science students. Williams (2010) suggests the importance of instructor immediacy – approaching student learners with a sense of psychological closeness that suggests understanding, empathy, and acknowledgment of the unique challenges faced in their learning. Onwuegbuzie (1998) also alludes to the importance of acknowledging the affective (i.e. emotion and mood-related) factors barriers to learning. The author highlights, however, the importance of positive emotion – in particular, hope, to reduce anxiety toward learning statistics. Hope is an emotion that arises when one perceives both capability and pathways towards a successful resolution of a challenging situation (Snyder et al., 2002), and can serve as an antidote towards the anxiety faced by students approaching research methods and statistics for the first time. The suggestion here also aligns with the broader field of study on the importance of emotions as part of the learning experience, particularly how achievement emotions can help reduce student statistics anxiety (Pekrun et al., Frenzel, 2007).

 Given the importance of affective processes in the effective teaching and learning experience of research and statistics modules, instructors can first acknowledge the emotional barriers (particularly anxiety) that accompany the learning of these content, and subsequently, structure ways that induce positive emotions (such as hope and curiosity) to spur students towards more approach-oriented behaviors in their learning experience. Course instructors may also take note of the importance of immediacy, which can help ease student anxiety when approaching complex and technical material for the first time. The suggestions provided here may, in Robertson and Kingsely's (2015) expression, help first-time learners transition from "reluctant scientists" to psychologists in due time. Such approaches can ultimately encourage and empower students towards greater autonomy and self-directed learning – important qualities for any budding scientist.

*Use Problem-based Approaches to Teaching Research; Employ both Formative and Summative Assessments*

Researchers have suggested – and tested, numerous approaches in the structuring of research methods course content to enhance the student learning experience. A number of these approaches involve the use of problem-based learning (PBL). PBL typically involves presenting students with a context-bound, detailed problem, to which the students are then required to discuss the problem with peers (usually in small groups), uncover additional details of the problem via additional inquiry where necessary, and finally, propose specific solutions or recommendations to the problem (Norman & Schmidt, 1992). PBL approaches have been applied to medical cases and in medical education. A similar approach employs the use of case studies, which usually include specific problems themselves; indeed, case studies are a form of PBL wherein students are invited to examine the case, analyze and present solutions to the case. Some empirical evidence – both from quantitative and qualitative accounts, suggests that this approach to teaching research methods and statistics can be beneficial to psychology students. Winn (1995), for instance, reports on research student participation in a compulsory, commissioned research project with the Regional Health Authority in the UK. The author finds that both the academic and experiential outcomes from student involvement in such applied, 'real-world' research are positive, allowing students to see the practical relevance of their research and statistics skills. The effectiveness of PBL applied to statistics is also evident from Karpiak's (2011) study, in which the author shows how this approach led to undergraduate students scoring higher than those who undertook the course in its traditional format. A meta-analysis by Dochy et al. (2003), consisting of 43 studies shows that PBL approaches were effective in enhancing learning skills in students. Interestingly, students exposed to PBL also remembered more of what they had learned prior.

More generally, Barraket (2005) highlights the value of using a variety of approaches – PBL and case studies, included, but also group work, role-play, and simulation as a means of transforming research pedagogy to one that is more student-centered. A bulk of the literature also suggests, at the more micro-level, that instructors should also aim to employ both formative and summative assessments in the teaching of research methods classes. The use of both approaches has been shown to increase student perceptions about the difficulty of the course – but importantly, result in an improvement in their grades for those courses (Robertson & Kingsley, 2015). Edwards and Thatcher (2004), likewise, suggest the use of ongoing assessments, and in their study employed weekly seminar sheets comprising a research proposal and statistical assignment in their research methods course. The authors report that this approach has been successful in enhancing student confidence in their research skills, along with increasing the overall passing rates for that subject. Collectively, the key lessons that can be drawn from this body of literature are (1) to incorporate more real-world, applied approaches to the teaching and assessment of research and statistics modules, (2) to use a variety of complementary teaching approaches where applicable, and (3) to use both summative and formative assessments in gauging student progress on these courses.

*Combine both Didactic and Student-led Approaches to Learning*

In addition to adopting applied and problem-based approaches to teaching, researchers also suggest a shift towards more student-centered learning in the teaching of research methods and statistics. A student-centered learning approach and orientation stands in contrast with the traditional, didactic approach, the latter characterized by a primarily one-way delivery of the course content by the instructor. Edwards and Thatcher (2004), for instance, show that this approach works particularly well, highlighting how tutors can help students engage with the course content in small learning settings. Their student-centered, tutor-led approach was found to be particularly effective in enhancing student engagement in the corresponding research module. Brinthaupt and Ananth (2018) propose a novel approach towards framing such a student-led approach to learning. These authors suggest that instructors frame the teaching of research methods and statistics as a course in which students learn a new language. In doing so, instructors can then encourage the shift from a didactic to a more 'conversational' approach to research methods, further encouraging dialogue, conversation, and interactions with students as they learn. Brinthaupt and Ananth (2018) go on to propose steps towards teaching research methods using this language analogy, with two of the key steps being to encourage students to communicate formally in the new language and encouraging them to converse with other new language learners. Pfeffer and Rogalin (2012) recommend the use of active learning and assignments and discussion-based learning as part of a three-pronged approach to teaching undergraduate research methods courses. Encouraging such a dialogue, in the spirit of openness and inquiry, can, according to these authors, be enriching for both the students and teaching staff. Such collaborative/ collaboration and discussion-based learning may be especially important for large class settings. Indeed, Crull and Collins (2004) stress the importance of employing student-centered learning – through group activities, for instance, to engage with students in research methods classes that consist of 70 or more students. The literature in this area overall suggests the importance of employing student-centered (and tutor-led) modes of instruction as a means of effectively teaching research. Given the technical and complex nature of research methods and statistics, however, it is nonetheless prudent to augment such approaches with the more traditional didactic approaches initially, before incrementally allowing students greater autonomy as they advance in their research skills (Barraket, 2005).

*Use Technology to Augment the Teaching and Learning of Research Methods and Scientific Thinking*

Our fourth and final suggestion to enhance in-class teaching and learning experience for research methods is based on advances in technological applications for education. Recent research highlights how the use of technology – particularly collaborative technology (i.e. digital tools that enhance group work and facilitate information seeking) may be useful in enhancing the learning experience (Vasquez-Colina et al., 2017). Morris and colleagues (2013), for example, argue for the use of games in the teaching of scientific thinking, suggesting that gaming environments can provide the necessary scaffolding and feedback necessary to help students understand the nature of science. These authors highlight how games provide several motivational scaffolds – feedback, rewards, and flow states (states of immersed, engaged concentration), along with cognitive scaffolds – simulations (trial-and-error) and embedded reasoning skills within games that can enhance the development of scientific thinking. Initial research on the effects of gamification on psychological and behavioral outcomes have been positive in enhancing learner motivation (e.g. Tan & Hew, 2016; Su & Cheng, 2015) and better performance on corresponding assessments (Huang et al., 2018). That said, researchers also highlight the importance of considering the context in which gamification is applied to the learning environment. Hanus and Fox (2015), for instance, show in a longitudinal study that gamification lowered learner motivation and satisfaction with the course – a point also stressed by Hamari et al. (2014) in their review. For this chapter, the authors acknowledge that technology does play an important role in enhancing student engagement with research methods and statistics courses – particularly through collaborative technology. Technology may also encourage open dialogue and inquiry within such modules, and, if elements of the course are gamified, may also lead to an increase in student motivation for the course. That said, it is argued that technology should be used as a complement to, rather than in place of, both student-led and didactic approaches discussed in the preceding sections.

Creating a Culture of Inquiry

Clearly, the cultivation of scientific thinking – and thinking skills, more generally, cannot be accomplished by changing approaches to teaching and learning within lectures alone. As such, the authors of this chapter propose that the creation of an environment – an ecosystem that encourages such approaches to thinking, is also reliant on the crafting of a teaching and learning culture that embodies, encourages, and rewards this form of thinking. In this section, two critical components towards creating such a culture are featured: (1) creating the necessary psychological scaffolds for inquisitive learning and (2) emphasizing teaching staff transformational leadership to craft a culture of inquiry.

**Create the Necessary Psychological Scaffolds for Inquisitive Learning**

Bell et al. (2005: 30) define inquiry, as "an active learning process in which students answer research questions through data analysis." The authors explain, with reference to the National Science Education Standards (NRC, 1996) that this form of learning emphasizes questioning, data analysis, and critical thinking, in the service of constructing and analyzing alternative explanations and communicating science. Importantly, however, these authors also stress the need to provide substantial scaffolding to students before they are sufficiently confident in forming their own scientific questions and designing research plans tailored to addressing those questions. In agreement with Bell and colleagues (2005), Kilbane and Clayton (2017) suggest two components crucial towards creating a culture of inquiry – autonomy, and authenticity. Zimbardi and colleagues (2013) recommend providing students with an appropriate level of autonomy – too much can, for instance, be daunting to students approaching research methods and the scientific process for the first time. Similarly, Gormally, et al. (2009) found that inquiry-based learning was effective in enhancing student self-confidence in a research methods course. These students, however, also reported experiencing more complexity and frustration relative to students who followed the traditional curriculum. Considering these suggestions, the necessary psychological scaffolds therefore need to be in place in order to encourage appropriate levels of autonomy and authenticity in the teaching and learning process. Several authors have proposed ways to do this. Barker and Holden (2017), for instance, suggest creating a learning environment in which making mistakes is acceptable, and scaffolding student learning by encouraging them to ask questions. They suggest doing so by providing students with relevant resources in which to spur further questioning, and allowing students to constantly 'rewrite, revise, and reimagine their inquiry questions (p.36).'

Another novel approach, suggested by Ferenc and colleagues (2018), is to use an 'intentionally flawed scientific manuscript.' Through this approach, the authors instruct student teams to each write an intentionally flawed manuscript describing the results of a simple experiment. Student teams then exchanged manuscripts and worked collaboratively to identify and critique the shortcomings of those manuscripts. Given that the scientific enterprise consists of constant experimentation, demand for evidence, error reduction, and tentative conclusions, the use of this creative approach can provide the necessary psychological scaffold and encouragement for students to question and critique. Ferenc and colleagues (2018) conclude by stating that the use of the intentionally flawed manuscript approach can help complement traditional, didactic approaches to creating a culture where scientific thinking is welcome. In summary, while the literature in this area suggests some teachers' hesitancy in adopting a culture of inquiry (Kilbane & Clayton, 2017), the authors concur with Barker and Holden (2017), in suggesting that instructors 'let it go' – to join the students in the process of learning themselves by being open to questions, encouraging curious, yet critical inquiry of the scientific literature, and creating in a collaborative learning environment where students know asking questions is a means by which one learns. Such approaches can help students see mistakes, and inaccuracies (for instance, via unsupported hypotheses) as a normal part of the scientific method, and of scientific thinking.

*Emphasize Teaching Staff Transformational Leadership to Craft a Culture of Inquiry*

Literature on fostering a culture of inquiry also emphasizes the importance of the instructor. In particular, the bulk of the research in this domain focuses on the role of transformational leadership, in impacting student achievement and engagement (see Leithwood & Jantzi, 2005 for a review). Van Zeer et al. (2006) for instance, examined how teacher leadership helped craft a culture of inquiry for a Master's-level program. The authors highlight the importance of instructor transformational leadership and the value of encouraging the involvement of students through inquiry and action research. Such endeavors ultimately developed students into leaders, as well as autonomous and self-directed learners themselves upon completion of their studies. In three studies, Morris (2017) examined the relationships between a culture of inquiry, teacher collaboration, and student achievement. Consistent with Valli and colleagues (2006), the studies reveal that teacher transformational leadership is essential in successfully crafting a culture of inquiry. Importantly, *Morris (2017)* emphasizes the need for collegiality and sharing. The findings here also allude to what Pfeffer and Rogalin (2012) suggest – to encourage more honest dialogue between teaching staff and students. When teaching staff has an honest dialogue with students on their own challenges, struggles, and failures in research, the learning environment is effectively transformed, shifting the learning culture from a didactic one to one that is more collaborative. Students see their instructors less as infallible authorities on the subject matter, but more as a collaborator in their journey of learning and understanding.

**Solutions and Recommendations**

Strategies for Building a Research Ecosystem and Culture of Inquiry: A Case Study of The Department of Psychology, HELP University

A summary of the key approaches towards building a research ecosystem and culture of inquiry is presented in Figure 1.

Figure 1: An Integrated Research Ecosystem Model.



In this section, the authors present strategies and approaches taken by the Department of Psychology, HELP University, a large private university in Malaysia, in building a research ecosystem and a culture of inquiry. The authors focus on the strategies adopted by the teaching staff towards the teaching and learning of research methods subjects, highlighting the unique approaches taken by the teaching staff towards enhancing the student learning experience. The Department of Psychology at HELP University is part of the university's Faculty of Behavioural Sciences and houses the country's most established undergraduate psychology program, the Bachelor of Psychology. At the time of writing, the Department of Psychology at HELP University has more than 1200 students in both its undergraduate and postgraduate programs from both Malaysia and overseas.

*Addressing Psychosocial Barriers to Research Methods Learning through Incremental Syllabus Design*

There are seven research methods and statistics courses in the Bachelor of Psychology program, namely: (a) Introduction to Quantitative Methods (PSY 105) (b) Introduction to Quantitative Methods 2 (PSY 107) (c) Introduction to Qualitative Methods (PSY106), (d) Scientific Thinking and Academic Writing (PSY113), (e) Advanced Quantitative Methods 1 (PSY201), and (f) Advanced Quantitative Methods 2 (PSY202) and (g) Data Analytics in Psychology (PSY 345). These research courses are structured in a way that allows students to progressively learn research methods and to put into practice the skills necessary for a scientific report. The incremental, progressive structure of the courses eases students into research, which helps allay possible anxieties in learning the new research 'language.' The student's initial exposure to research methods in PSY105, for instance, encompasses the fundamentals of research. This includes topics highlighting the broad differentiation between analytical approaches (causal experimental versus correlational survey-based designs), and an introduction to ethical research, along with an introduction to the fundamentals of data analysis using statistical software. In PSY106, students are then introduced to qualitative research. For this module, students are allowed to openly discuss their proposed qualitative research topics as part of their assignment. They are also given the opportunity to formulate interview questions – and then partake in an in-class interview and focus-group session in order to quickly learn interviewing and focus-group facilitation skills. In the second year, students then complete PSY201 and PSY202, the advanced research methods modules, where they are given hands-on practice for running various statistical tests in practical lab sessions. Such sessions allow for students to attain immediate feedback and suggestions from both the software and the graduate tutor on best approaches towards cleaning data, preparing data for preliminary analyses, and identifying outliers, before the focal analyses and hypotheses tests are conducted.

*Using Problem-based Approaches to Address Real-world Research Problems*

Beginning in PSY105, students are exposed to different types of research designs, and this is promptly followed by in-class and in-lecture assessments that require them to identify which research designs are depicted in a series of real-world scenarios. Students in PSY 106, likewise, are tasked to identify applications of qualitative methods for researching certain topics within the social sciences. This tends to involve asking the students to assess the suitability of qualitative methods to aid in the understanding of topics related to culture, lived experiences, and subjective views. For PSY113, students are exposed to published scientific reports and asked to critique them – one of them being the intentionally flawed or poorly-written lab report. In addition to being tasked to extract information from these published studies, students are also asked to think about the real-world, practical implications of the studies, and how findings from the psychological sciences can be used as a foundation for effective real-world interventions and/or treatments. For this module, students are asked to work in groups and make formal presentations from their groups' critique of the articles. Students taking the two advanced research methods courses, PSY201 and PSY202 are then tasked to consider the practical, real-world implications of their studies. Such an exercise would require them to consider the contributions their studies would make for the betterment of their studied population or notable interest groups.

*Making Research Education a Conversation*

In the Department of Psychology's efforts to encourage further student-centric learning, all research modules consist of tutorial sessions that require students to describe their personal experiences and reflections from conducting their own studies. For instance, in tutorial activities for PSY113 and PSY201, instructors and module leaders give immediate feedback to student presentations as part of the course's assessment. This two-way communication and feedback allow for greater instructor immediacy and correcting any fundamental flaw in the student's proposed research design. In their penultimate research module, PSY202, students are allowed to develop their own research ideas and design their own study to answer a research question of their own formulation. The face-to-face consultation sessions with the respective instructors allow for a more conversational and interactive approach to research learning and allow students greater autonomy in researching on their own. This effectively combines the traditional didactic approach with a more student-led approach, leading to greater engagement with the material.

The Department of Psychology also holds the Psychology Research Colloquium at the end of every semester. The colloquium is an in-house research conference that allows psychology undergraduates to present their research to faculty members and students in the program. The colloquium presentation also allows students to gain the experience of participating in and presenting at an academic conference. In further support of encouraging students to share their work beyond the department and the university, the department sets aside funding every year for undergraduate students to present their research papers at local and international psychology conferences. This fund called the Academic Research Conference (ARC) fund, has been effective in allowing students opportunities to attend, present, and network with researchers the world over. In the last five years, over 400 HELP psychology students have received funding from the department to present their findings at conferences around the world.

*Using Technology to Augment the Teaching and Learning of Research and Scientific Thinking*

Faculty members use technology such as Google Classrooms (a free web platform that assists in disseminating and grading assignments), Microsoft Teams, Padlet, and Kahoot for their research modules such as – PSY105, PSY113, and PSY202. The use of technology is effective in enhancing the efficiency of syllabus delivery and in communicating feedback to the students. The web platform has helped facilitate expedited and convenient communication between students and instructors and has also allowed the graduate tutoring team to quickly identify common errors and misunderstandings in students' learning of the subject material. For PSY105 and PSY201, the teaching team has also used Google Classrooms to share instructional videos for the use of the Statistical Packages for the Social Sciences (SPSS) to students, providing them with additional reference material that encourages self-directed learning. The Department of Psychology has also invested in new technologies, housed within the new Virtual Reality (VR) and Electroencephalography (EEG) Labs. Research employing virtual reality tools (namely, studies on simulated environments, ergonomics, and computer-human interactions), along with neuroscience research will benefit directly from the use of technologies within these two laboratories. Given the Department's goal of readying students for a volatile, uncertain, complex, and ambiguous (VUCA) world, along with the 4th (and subsequently 5th) Industrial Revolutions, these technologies will be helpful not just for research, but in helping students become acquainted with tools that may help shape their understanding of the human mind in the near future. The HELP Psychology program is, in short, designed and committed to preparing our graduates to be adaptable and to thrive in environments that are consistently in flux.

*Creating the Necessary Psychological Scaffolds for Inquisitive Learning: Culture and Instructor Leadership*

The Department of Psychology also organizes the Academic Research Training (ART) program as a means of creating a research-friendly and research-supportive culture. The ART program is a research mentorship program for undergraduate psychology students to work on research and consulting projects with different members of the Faculty of Behavioural Science and can be likened to a research internship program. Approximately 100 places are offered every semester for students to be exposed to, and work on research areas that are specific to each staff member's expertise and interests. Academic staff is encouraged to provide support and encouragement to students as they assist with their projects. As leaders of their respective projects, academic staff is given the autonomy and responsibility to create a learning environment and experience for their ART trainees that would otherwise not be possible within more formal classroom settings. To focus research efforts and effectively match student interest with academic staff research expertise, the Department groups its staff research interests based on research centers. The research centers revolve around key staff expertise and are also engaged in several outreach programs in addition to conducting academic research. At the time of writing, the Department of Psychology at HELP University houses 11 research centers and 2 research labs covering a diverse range of research interests:

Table 1: List of Research Centers and Labs at the Department of Psychology, HELP University.

|  |  |
| --- | --- |
| Center | Description |
| Existential-Humanistic Psychology  | Face the questions about life, death, meaning, and what it means to be human beings, as these are questions integral to us at some points in our life.Encourage dialogues on the most basic questions of our lives, and cultivate a life of meaning and significance. |
| Family and Parenting | Provide parents with resources and services to build strong families in the efforts to enhance family relationships.Helping parents support their children in achieving their full potential. |
| EEG (Cerebro Lab) | Conduct experiments employing electroencephalography (EEG)Part of the Department of Psychology’s biopsychology and neuropsychology lab modules. |
| Creative Therapy | Create a unique avenue incorporating expressive arts, where supportive relationships are established and where coping skills are enhanced, resulting in a happy, resilient, and productive citizenry.  |
| Diversity | Advance academic and public understanding of key issues facing Malaysian society from the perspectives of community, social, and political psychology, with a focus on intergroup relations and leadership. |
| Memory | Conduct research on cognitive processes, with a focus on applications of memory training and comparative models of memory formation.  |
| Psychology of Play | Incorporate the psychological principles related to play and cognitive exploration, and employ them towards designing fun, engaging, and enlightening mechanics of play in a world of endless busyness and productivity. Run multiple research projects to examine the psychological need for games and the impact of games on group and individual behavior. Explore creative and novel ways of teaching via psychologically informed games. |
| School and Educational Psychology | Provide support for schools through the introduction of psychological assessments, improved teaching practices, and the strengthening of school counseling and support systems. |
| Work Psychology | Examine how psychology can help zorganizations be more successful and adaptive by better understanding and managing their talents, as well as the psychology of work. |

|  |  |
| --- | --- |
| Emotions | Equip individuals with workable, practical knowledge of emotions from the psychological sciences, so they will be able to lead healthier, more meaningful lives. |
| Special Education Needs (CSEN) | Promote inclusion and support inclusive practices in early years settings, primary and secondary mainstream schools, and institutions of higher learning nationwide for students requiring Special Educational Needs (SEN). |
| Centre for Research on Aging | Understand issues that pertain to aging and working with older adults and how psychology can facilitate the process of active and healthy aging |
| VR (Lab) | Conduct experiments employing virtual reality (VR) tools and VR-based stimuli.  |

**Conclusion**

**Creating a New Generation of Psychology Scholars: Critical, Scientific and Ethical**

It is imperative that students develop skills that enable them to be more critical thinkers and effective decision-makers. The world in which the current generation of students will be facing will be filled not just with challenges, but with opportunities. In this chapter, it is argued that one crucial skill that will allow students to operate effectively in an uncertain and demanding world is scientific thinking. Science, as a means of knowing, requires students to critically, and carefully, distinguish between evidence-based claims from those which are pseudoscientific, conjecture, or those which are (merely) unsubstantiated opinions. This is even more important considering recent dubious claims made in the name of science, which can sometimes lead to harmful consequences. The call for more evidence-based approaches is made even more apparent in the psychological sciences, which asserts that certain interventions or treatments can be used to manage psychological or physical illnesses. Further, given the major economic, social, environmental, and political shifts brought about by the 4th Industrial Revolution, university curricula need to address the pressing need to develop scientific literacy as part of its graduates' thinking skills. It is argued that the psychological sciences play a crucial role in developing these much-needed skills. In particular, the research-relate modules can serve to help students develop these essential thinking tools. The university and its instructors play a particularly important role in shaping not just the curricula or syllabus, but also in crafting a culture that is conducive to the development of critical and reasoned thinking. It is hoped that the steps taken by the Department of Psychology, at HELP University meet this overarching objective, and provide a useful framework for helping students become better thinkers, for a better nation.

**Acknowledgment**

The authors of this chapter thank Raja Intan Arifah binti Raja Reza Shah and James Yeow for their feedback on earlier drafts of this work.

**References**

Abdullah, T., & Brown, T. L. (2011). Mental illness stigma and ethnocultural beliefs, values, and norms: An integrative review. *Clinical Psychology Review*, *31*(6), 934-948. <https://doi.org/10.1016/j.cpr.2011.05.003>

Ash, M. G. (1980). Academic politics in the history of science: Experimental psychology in Germany, 1879–1941. Central European History, 13(3), 255-286. <https://doi.org/10.1017/s0008938900009602>

Barker, K., & Holden, P. (2017). Let It Go. *Knowledge Quest*, *46*(2), 36-41.

Barraket, J. (2005). Teaching research method using a student-centered approach? Critical Reflections on Practice. *Journal of University Teaching and Learning Practice*, *2*(2), 3. <https://doi.org/10.53761/1.2.2.3>

Bell, R. L., Smetana, L., & Binns, I. (2005). Simplifying inquiry instruction. *Science Teacher*, 72(7), 30–33.

Ben-Shakhar, G., Bar-Hillel, M., Bilu, Y., Ben-Abba, E., & Flug, A. (1986). Can graphology predict occupational success? Two empirical studies and some methodological ruminations. *Journal of Applied Psychology*, *71*(4), 645-653. <https://doi.org/10.1037/0021-9010.71.4.645>

Bensley, D. A., Crowe, D. S., Bernhardt, P., Buckner, C., & Allman, A. L. (2010). Teaching and assessing critical thinking skills for argument analysis in psychology. *Teaching of Psychology*, *37*(2), 91-96. https://doi.org/10.1080/00986281003626656

Brinthaupt, T. M., & Ananth, P. (2018). Teaching students to speak fluent “research.” *Scholarship of Teaching and Learning in Psychology, 4*(4), 258–270. <https://doi.org/10.1037/stl0000128>

Cramer, K. M., & Imaike, E. (2002). Personality, blood type, and the five-factor model. *Personality and Individual Differences*, *32*(4), 621-626. [https://doi.org/10.1016/S0191-8869(01)00064-2](https://doi.org/10.1016/S0191-8869%2801%2900064-2)

Crull, S. R., & Collins, S. M. (2004). Adapting traditions: Teaching research methods in a large class setting. *Teaching Sociology, 32*(2), 206–212.

  <https://doi.org/10.1177/0092055X0403200206>

Davidson, P. R., & Parker, K. C. (2001). Eye movement desensitization and reprocessing (EMDR): A meta-analysis. *Journal of Consulting and Clinical Psychology*, *69*(2), 305-316. <https://doi.org/10.1037//0022-006X.69.2.305>

Dochy, F., Segers, M., Van den Bossche, P., & Gijbels, D. (2003). Effects of problem-based learning: A meta-analysis. *Learning and Instruction*, *13*(5), 533-568.

 [https://doi.org/10.1016/S0959-4752(02)00025-7](https://doi.org/10.1016/S0959-4752%2802%2900025-7)

Edwards, D. F., & Thatcher, J. (2004). A student-centered tutor‐led approach to teaching research methods.*Journal of Further and Higher Education,*28(2), 195-206. <https://doi.org/10.1080/0309877042000206750>

Ferenc, J., Cervenák, F., Bircák, E., Juríková, K., Goffová, I., Gorilák, P., … Tomáška, L. (2018). Intentionally flawed manuscripts as a means for teaching students to critically evaluate scientific papers. *Biochemistry and* *Molecular Biology Education*, 46(1), 22–30. <https://doi.org/10.1002/bmb.21084>

Gormally, C., Brickman, P., Hallar, B., & Armstrong, N. (2009). Effects of inquiry-based learning on students’ science literacy skills and confidence. *International Journal for the Scholarship of Teaching and Learning*, 3(2). <https://doi.org/10.20429/ijsotl.2009.030216>

Hamari, J., Koivisto, J., & Sarsa, H. (2014, January). Does gamification work?-A literature review of empirical studies on gamification. In *2014 47th Hawaii International Conference on System Sciences (HICSS)* (pp. 3025-3034). IEEE. <https://doi.org/10.1109/hicss.2014.377>

Hansson, S. O. (2013). Defining pseudoscience and science. *The Philosophy of Pseudoscience*, 61-77. <https://doi.org/10.7208/chicago/9780226051826.003.0005>

Hanus, M. D., & Fox, J. (2015). Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance. *Computers & Education*, *80*, 152-161.

<https://doi.org/10.1016/j.compedu.2014.08.019>

Huang, B., Hew, K. F., & Lo, C. K. (2018). Investigating the effects of gamification-enhanced flipped learning on undergraduate students’ behavioral and cognitive engagement. *Interactive Learning Environments*, 1-21. <https://doi.org/10.1080/10494820.2018.1495653>

Hussain, R. M. R., Mamat, W. H. W., Salleh, N., Saat, R. M., & Harland, T. (2007). Problem‐based learning in Asian universities. *Studies in Higher Education*, *32*(6), 761-772. <https://doi.org/10.1080/03075070701685171>

Karpiak, C. P. (2011). Assessment of problem-based learning in the undergraduate statistics course. *Teaching of Psychology*, *38*(4), 251-254. <https://doi.org/10.1177/0098628311421322>

Kilbane, J., & Clayton, C. (2017). Knowledge seekers: New York program creates a culture of inquiry among high school teachers and their students. *Learning Professional*, 38(6), 32–37.

Koerber, S., Mayer, D., Osterhaus, C., Schwippert, K., & Sodian, B. (2015). The development of scientific thinking in elementary school: A comprehensive inventory. *Child Development*, *86*(1), 327-336. <https://doi.org/10.1111/cdev.12298>

Lauber, C., & Rössler, W. (2007). Stigma towards people with mental illness in developing countries in Asia. *International Review of Psychiatry*, *19*(2), 157-178.

 <https://doi.org/10.1080/09540260701278903>

Leithwood, K., & Jantzi, D. (2005). A review of transformational school leadership research 1996–2005. *Leadership and Policy in Schools*, *4*(3), 177-199. <https://doi.org/10.1080/15700760500244769>

Macher, D., Paechter, M., Papousek, I., & Ruggeri, K. (2012). Statistics anxiety, trait anxiety, learning behavior, and academic performance. *European Journal of Psychology of Education*, *27*(4), 483-498. <https://doi.org/10.1007/s10212-011-0090-5>

Millman, K. J. (2011). The challenge of reproducible research in the computer age.

Morris, B., Croker, S., Zimmerman, C., Gill, D., & Romig, C. (2013). Gaming science: the “Gamification” of scientific thinking. *Frontiers in Psychology, 4*, 607.

<https://doi.org/10.3389/fpsyg.2013.00607>

Morris, W. V. (2017). Culture of Inquiry in professional development. *International Journal of Educational Reform*, *26*(2), 123-131. <https://doi.org/10.1177/105678791702600202>

National Research Council (NRC). (1996). National science education standards. Washington, DC: National Academy Press.

Norman, G. T., & Schmidt, H. G. (1992). The psychological basis of problem-based learning: a review of the evidence. *Academic Medicine*, *67*(9), 557-565.

<https://doi.org/10.1097/00001888-199209000-00002>

Onwuegbuzie, A. J. (1998). Role of hope in predicting anxiety about statistics. *Psychological Reports*, *82*, 1315-1320. <https://doi.org/10.2466/pr0.1998.82.3c.1315>

Onwuegbuzie, A. J. (2004). Academic procrastination and statistics anxiety. *Assessment & Evaluation in Higher Education*, *29*(1), 3-19. <https://doi.org/10.1080/0260293042000160384>

Onwuegbuzie, A. J., & Wilson, V. A. (2003). Statistics anxiety: Nature, etiology, antecedents, effects, and treatments--a comprehensive review of the literature. *Teaching in Higher Education*, *8*(2), 195-209. <https://doi.org/10.1080/1356251032000052447>

Pan, W., & Tang, M. (2004). Examining the effectiveness of innovative instructional methods on reducing statistics anxiety for graduate students in the social sciences. *Journal of Instructional Psychology*, *31*(2), 149-159.

Pan, W., & Tang, M. (2005). Students' perceptions on factors of statistics anxiety and instructional strategies. *Journal of Instructional Psychology*, *32*(3), 205-214.

Pekrun, R., Frenzel, A. C., Goetz, T., & Perry, R. P. (2007). The control-value theory of achievement emotions: An integrative approach to emotions in education. In *Emotion in education* (pp. 13-36). <https://doi.org/10.1016/B978-012372545-5/50003-4>

Pfeffer, C. A., & Rogalin, C. L. (2012). Three strategies for teaching research methods: A case study. *Teaching Sociology, 40*(4), 368–376. <https://doi.org/10.1177/0092055X12446783>

Robertson, J. M., & Kingsley, B. E. (2015). Teaching Research Methods to Encourage the Transition from “Reluctant Scientist” to Psychologist: A Longitudinal Study. *Psychology Teaching Review, 21*(1), 44–55. <https://doi.org/10.53841/bpsptr.2015.21.1.44>

Rogers, M., & Glendon, A. I. (2003). Blood type and personality. *Personality and Individual Differences*, *34*(7), 1099-1112. [https://doi.org/10.1016/S0191-8869(02)00101-0](https://doi.org/10.1016/S0191-8869%2802%2900101-0)

Sagan, C. (1995). Science as a candle in the dark. The demon-haunted world. New York: Random House.

Schmaltz, R. M., & Lilienfeld, S. O. (2017). Novel approaches to teaching scientific thinking: Psychological Perspectives. *Frontiers in Psychology*, *8*, 820.

<https://doi.org/10.3389/fpsyg.2017.00820>

Snyder, C. R., Rand, K. L., & Sigmon, D. R. (2002). Hope theory. *Handbook of Positive Psychology*, 257-276.

Stark, E. (2012). Enhancing and assessing critical thinking in a psychological research methods course. *Teaching of Psychology*, *39*(2), 107-112.

<https://doi.org/10.1177/0098628312437725>

Su, C. H., & Cheng, C. H. (2015). A mobile gamification learning system for improving the learning motivation and achievements. *Journal of Computer Assisted Learning*, *31*(3), 268-286. <https://doi.org/10.1111/jcal.12088>

Tan, M., & Hew, K. F. (2016). Incorporating meaningful gamification in a blended learning research methods class: Examining student learning, engagement, and affective outcomes. *Australasian Journal of Educational Technology*, *32*(5). <https://doi.org/10.14742/ajet.2232>

Van Zeer, E. H., Valli, L., van Zee, E. H., Rennert-Ariev, P., Mikeska, J., Catlett-Muhammad, S., & Roy, P. (2006). Initiating and sustaining a culture of inquiry in a teacher leadership program. Teacher Education Quarterly, 33(3), 97-114.

Vasquez-Colina, M. D.., Maslin-Ostrowski, P., & Baba, S. (2017). Tapping into Graduate Students’ Collaborative Technology Experience in a Research Methods Class: Insights on Teaching Research Methods in a Malaysian and American Setting. *International Journal of Teaching & Learning in Higher Education, 29*(2), 281–292.

Williams, A. S. (2010). Statistics anxiety and instructor immediacy. *Journal of Statistics Education*, *18*(2).  https://doi.org/ 10.1080/10691898.2010.11889495

Witkowski, T. (2010). Thirty-five years of research on Neuro-Linguistic Programming. NLP research database. State of the art or pseudoscientific decoration? *Polish Psychological Bulletin*, *41*(2), 58-66. <https://doi.org/10.2478/v10059-010-0008-0>

Zeidner, M. (1991). Statistics and mathematics anxiety in social science students: Some interesting parallels. *British Journal of Educational Psychology*, *61*(3), 319-328. <https://doi.org/10.1111/j.2044-8279.1991.tb00989.x>

Zimbardi, K., Bugarcic, A., Colthorpe, K., Good, J. P., & Lluka, L. J. (2013). A Set of Vertically Integrated Inquiry-Based Practical Curricula that Develop Scientific Thinking Skills for Large Cohorts of Undergraduate Students. *Advances in Physiology Education* (Vol. 37, pp. 303–315). https://doi.org/10.1152/advan.00082.2012