Conceptual Article

CUDOs to the teachers: Using Merton's norms of scientific practice to guide lessons in critical thinking

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Professors are often exhorted to foster an atmosphere in critical thinking in their classes, and there is a wide variety of lessons and activities that college students can be given in order to keep their questioning spirit alive. In this paper, the researcher sets critical thinking against the framework of Merton's Norms of scientific practice. Robert Merton's work has been used in the philosophy and sociology of science as a way to discuss what constitutes a scientific culture. The norms are summarized in the acronym CUDOs: Communalism (scientific knowledge is open to all), Universalism (that the practice of science is open to everyone), Disinterestedness (scientists do research for the greater good and not their personal gain), and Organized Skepticism (scientists always operate from a default of skepticism, and constantly question new findings in systematic ways.) These norms can be applied to tertiary classrooms to show students that scientific thinking is not monopolized by those in the scientific field, and that part of this scientific thinking is an organized, critical approach to appraising the world. The researcher provides examples from her own classes and assesses her practice and future directions for critical thinking instruction at the tertiary level.

Keywords: Mertonian norms, critical thinking, science culture, teaching research, college teaching, teaching science communication, teaching belly dance

1. Introduction

Today's social media environment has become toxic for anyone using social media platforms for information: fake news, misinformation, disinformation, and trolls have permeated our landscape, presenting what researchers call "real threats" to democratic free speech, public debate, and to some extent, public health and well-being (Brazel, 2020; Motz et al., 2022; Tsui, 1999). Navigating social media now requires stronger mental tools, including critical thinking, which might entail an ability to discern fact from fiction (Indrasiene et al., 2021; Kraus et al., 2013), knowledge about how social media actually works (Brookfield, 2015), and even wisdom on how science works, given the tabloid news that might have little scientific merit but great popularity (Hogan & Sweeney, 2013). Without these skills, social media can have dangerous consequences (Motz et al., 2022). Take, for instance, the sudden spread of unregulated ivermectin use during the COVID-19 pandemic, when there was so little information available, but so much punditry. In the Philippines, the spread of information and the increase of troll farms have been linked to the rise to power of the son of the country's former dictator.

Critical thinking skills, however, have not been observed in the workplace, prompting calls for it to be taught more deliberately (Bellaera et al., 2021; Indrasiene et al., 2021; Kumar & James, 2015). Critical thinking skills have been shown to prepare students for higher education (Kumar & James, 2015), improve a student's chances of being admitted to honors programs (Leest & Maarten, 2021), raise chances for academic achievement (Bellaera et al., 2021; Shaheen, 2016), increase their chances of employability (Bellaera et al., 2021; Fadhlullah & Ahmad, 2017; Kumar & James, 2015), and increase the chances for such employees to be more confident and adaptable in the workplace (Indrasiene et al., 2021; Liu et al., 2014). Such students also tend to think more systematically, maturely, and independently later on (Fadhlullah & Ahmad, 2017; Fernandez & Padilla, 2020).

Without critical thinking skills, people, in general, might not have the tools to survive modern society. Students tend to copy ideas and pass them off as their own, or to accept ideas as dogma without first questioning them (Shaheen, 2017). They tend to share ideas without checking their veracity or integrity (Brazel, 2020). Some tests on critical thinking predict that lack of it might cause people to damage their health, mismanage their time and finances, engage in harmful behavior, neglect their academics, and plunge too readily into decisions that would otherwise have required more careful thought (Franco et al., 2017).

This combination of a lack of observable critical thinking skills and the potential of social media misuse to cause widespread damage make it imperative to introduce critical thinking instruction, especially in higher education (Indrasiene et al., 2021) – and with the aim of enhancing students' thinking skills and understanding of various social issues, so that they can practice these skills both inside and outside the classroom (Fadhlullah & Ahmad, 2017; Quintana & Schunn, 2019). With the large amounts of information and the quick turnover of what information is considered valid and truthful, students need to acquire knowledge quickly and make sound decisions based on their judgement (Baylon, 2014; Behar-Horenstein & Niu, 2011; Leest & Maarten, 2021), and critical thinking is surmised to assist in honing this ability.

However, many instructors are already burdened with tight schedules and large classes, and do not receive training in teaching critical thinking; there, too, is no infrastructure to help them assess the more complex requirements that come with measuring critical thinking in practice (Fadhlullah & Ahmad, 2017; Marquez, 2017). College instructors, moreover, are digital immigrants who are teaching digital natives (Brookfield, 2015): college instructors can see the forest for the trees, but students will probably take so much for granted, that they cannot see how they are already so immersed in their world and cannot escape it; conversely, college instructors cannot sympathize with the pitfalls of being so immersed on social media, but students will know the very real dynamics – both intellectual and emotional – that social media can bring.

Research has also shown that the lecture-and-exam format of instruction, as well as rote memorization orientation of many universities, also tends to make students too focused on receiving high grades rather than acquiring skills in thinking, such that students simply accept what is given to them and expect teachers to simply hand them information to make them pass their tests (Benedicto & Andrade, 2022; Dela Cruz, 2012; Fadhlullah & Ahmad, 2017). Schools often teach students what to think, rather than how to think, which hampers the learning process and the process through which that learning can be translated to action in a volatile, changing real world (Baylon, 2014; Behar-Horenstein & Niu, 2011). For instance: students are sometimes made to solve the same problems that teachers do, so that when they are called upon to solve analogs of these problems in the outside world, they cannot translate their school tasks to real-world actions (Benedicto & Andrade, 2022).

The link between critical skills development and classroom instruction, however, has not always been observed empirically, even as there is some positive association between interactive classroom activities (active learning modalities) and certain college courses with self-reported critical thinking skills (Baylon, 2014; Terenzini et al., 1995; Tsui, 1999). To Terenzini et al. (1995), academic and out-of-classroom experiences complement each other in strengthening critical thinking. Nevertheless, with the emergent nature of the 21st century classroom, critical thinking must both be taught in classrooms, and interrogated as a construct within changing contexts (Belecina & Ocampo, 2018).

Above and beyond the classroom environment, moreover, is a possible cultural component. Students who come from cultures with traditional views of the nature and role of authority tend to be hampered in their critical thinking skills because such cultures also do not support the use of analytical thinking – or, to be more precise, such students might come from educational pedagogies that adhere to such structures, that they tend to be less self-directed and therefore less critical when they arrive at foreign, Western universities and must demonstrate critical thinking (Shaheen, 2016).

Another quandary arises: how exactly is critical thinking defined? Given this, then, how should it be taught?

2. Challenges in Thinking about Critical Thinking

Critical thinking, as a construct, might actually be known by other names. It might be classified as an intellectual virtue, rather than a moral virtue. It is not about what someone thinks or how people should live, but how people should think (Mulnix, 2012). Other researchers make a distinction between critical thinking skills and dispositions; that is, between what one does and the attitudes that come with critical thinking (Indrasiene et al., 2021); or, similarly, the process versus the products of such thinking (Liu et al., 2014).

Perhaps a useful way to characterize critical thinking is to examine it as one of many different ways by which reasoning can be carried out.

Similar to critical thinking is the intellectual thought process, often contrasted in the literature with the psychological thought process (Block & Russell, 2012). The intellectual thought process involves analyzing an issue rationally and then clarifying it, checking for truth, inferring meaning, finding connections with other issues, examining alternative points of view, and logically reasoning through these alternatives. On the other hand, the psychological thought process involves governing one's thinking by assumptions. That is, when confronted with questions, a person will assume that what they know is already true because everyone else already knows it to be true, that the reward of group inclusion also validates the belief, that time has cemented the belief and therefore made it true, and that the status quo must remain the same. This is often labeled egocentric thinking, because it fails to consider other views while over-stressing one's view, and while shielding the "thinker" from the notion that they are actually selfish and have not truly weighed all options. Needless to say, the intellectual thought process is higher order thinking, while the psychological thought process is not.

Critical thinking bears some resemblance to this intellectual thought process. Some researchers have defined it as independent thinking (Enderun Colleges, 2018; Fernandez & Padilla, 2020), or a set of skills that can be used across different contexts, regardless of an issue (Abrami et al., 2015; Quintana & Schunn, 2019). This skillset might include the ability to detect and identify fallacious arguments, as well as to reason why some claims are valid while others are not (Brookfield, 2015; Krause et al., 2013; Motz et al., 2022; Terenzini et al., 1995); tease apart an argument, compare and contrast it, and examine its veracity (Alwehaibi, 2012; Enderun Colleges, 2018); identify the assumptions that cloud reason (Brookfield, 2015); engage in argumentation (Quintana & Schunn, 2019); use logic to reflect on an argument (Behar-Horenstein & Niu, 2011); solve problems for which there is no single correct answer (Peach et al., 2007); and examine an idea from varying perspectives (Brookfield, 2015; Fernandez & Padilla, 2020; Kraus et al., 2013; Mulnix, 2012). Kumar and James (2015), in particular, break down the components of critical thinking: inference, or drawing conclusions from factual data; assumptions, or providing ideas that presuppose another; deduction, or seeing if something can logically follow from a statement; interpretation, or seeing if different statements are logical conclusions of a statement; and evaluation, or the ability to see if an argument is strong or weak.

Some definitions might even also include creativity, problem solving, and healthy skepticism (Motz et al., 2022), although Leest and Maarten (2021) distinguish critical thinking (systematic and precise thinking) from the act of creativity (coming up with new and alternative ideas). Liu et al. (2014) argue that even knowledge of statistics should be a part of critical thinking, given that quantitative skills are both highly valued in the workplace but the least observed amongst graduates. Some stakeholders even confuse it with criticism, even as critical thinking has more to do with claims evaluation rather than outright claims-making (Indrasiene et al., 2021).

Another challenge is to actually measure critical thinking as a construct, a challenge that is tied to its definition. Motz et al. (2022) worked on research predicated on the definition that participants needed to know how to identify illogical or biased claims, which then led to research on how well participants could identify the fallacies in claims given by the researchers. Bae (2018)

indirectly measured critical thinking via curiosity: curiosity spurs critical thinking later, but, in and of itself, occurs when students see how new knowledge is relevant to and meaningful in their lives.

Not all research, however, points to the same definitions of critical thinking. Research argues that critical thinking cannot be transferred across knowledge domains, because its application rests heavily on knowledge of a topic (Liu et al., 2014; Mulnix, 2012) although research does dispute this claim (Bellaera et al., 2021; Motz et al., 2022). There, too, is a debate on whether critical thinking can be taught or even measured, or if it should even be defined in a way that seemingly shuts out the imagination and emotions (Mulnix, 2012). Some researchers, moreover, claim that critical thinking – characterized by a deep examination of issues – might be reserved for novel events for which people have no prior experience; everyday events might be driven more by instinct and intuition (Franco et al., 2007).

Not all critical thinking skills are given equal weight, at least in the humanities and social sciences, according to a survey of college instructors in the UK and US: the most important skills include analysis, evaluation, and interpretation, while the least important ones are creativity, deduction, description, and problem solving (Bellaera et al., 2021). In Lithuania, faculty, students, employees, and employers all agree that inference and argumentation are the most important critical thinking skills (Indrasiene et al., 2021).

3. Critical Thinking: Instruction and Practice

There still exists a debate on whether critical thinking can actually be taught; and alongside this debate, whether it should be taught as a set of skills in an entirely isolated subject, or as a subset of skills embedded in disciplines and separate classes (Behar-Horenstein & Niu, 2011). Some researchers have also critiqued the standardized testing of critical thinking skills, arguing that such testing is unreliable and cannot translate to assessment of real-world critical thinking (Liu et al., 2014). Whatever the method, research has also found that critical thinking is taught best when it is contextualized and taught explicitly within different subject areas, so that students practice it rather than simply read how it is done (Behar-Horenstein & Niu, 2011; Bellaera et al., 2021; Fernandez & Padilla, 2020; Franco et al., 2017; Motz et al., 2022; Mulnix, 2012; Taguiam, 2022).

Critical thinking instruction, too, has to overcome the predilection of standardized education, in general, for multiple-choice "objective" examinations, which reduce knowledge to camps of true vs. false rather than invite debate and argumentation, the hallmarks of critical thinking (Behar-Horenstein & Niu, 2011). Some scholars might also point to the potential for faculty and students to be at cross-purposes on the nature and process of critical thinking; however, research disputes this and shows that instructors can be focused on critical thinking as a process, while students can be preoccupied with the product of that process (Lloyd & Bahr, 2010). Some research points, too, to the tendency for one's deep engagement with one's peers to also suspend one's tendency to think critically in favor of subscribing to the majority view for the sake of cohesion and belongingness (Terenzini et al., 1995). On a broader level, research also shows that students tend not to engage in critical thinking at the academic level, since their society of origin views the use of critical thinking, and even critique, as seditious (Shaheen, 2016). Researchers, therefore, recommend that critical thinking education first be supported by an understanding of students' cultures and needs (Shaheen, 2016).

There is a wide variety of lessons and activities for college students to learn and practice critical thinking. Professors and researchers have used techniques such as: dialogue and discussion around real-world problems (Abrami et al., 2015; Alwehaibi, 2012; Bellaera et al., 2021; Benedicto & Andrade, 2022; Hayes, 1990; Kraus et al., 2013; Peach et al., 2007); reflections on a social issue (Lloyd & Bahr, 2010); problem solving and role playing (Abrami et al., 2015; Enderun Colleges, 2018); working on false claims and categorizing them according to their fallacies (Motz et al., 2022); critiquing the media and other popular representations of an issue (Lloyd & Bahr, 2010); honing the ability of students to ask questions about an issue through dialogues, debates, and interactive learning (Baylon, 2014; Enderun Colleges, 2018; Fadhlullah & Ahmad, 2017); brainstorming, collaboration, and looking at alternative ways of interpreting information (Enderun Colleges, 2018;

Krause et al., 2013); fact checking and plagiarism checking (Brazel, 2020); introducing philosophy as a subject even at lower grade levels (Marquez, 2017); and even making students think about their process of thinking, or metacognition (Alwehaibi, 2012). Teaching can be explicit, where critical thinking is taught as a module or separate subject, such as when universities offer freshman seminars, senior capstone courses, or critical thinking programs to assess the integration of knowledge and skill in a discipline (Alwehaibi, 2012; Baylon, 2014; Belecina, & Ocampo, 2018; Fernandez & Padilla, 2020; Peach et al., 2007; Quintana & Schunn, 2019); or implicit, where critical thinking skills are assumed to arise from work on the subject (Bellaera et al., 2021).

There, too, are specific methods for teaching critical thinking. Previous research, for example, says that students should be able to follow a step-by-step method of stating a problem succinctly, elaborating on it, explaining it, and then illustrating it (Block & Russell, 2012). Critical thinking can also be developed through mathematics (Belecina, & Ocampo, 2018; Benedicto & Andrade, 2022) or English literature instruction (Hayes, 1990). In the former, students learn how to solve problems in systematic ways, particularly through strategizing their solutions to mathematics problems without copying techniques shown by their instructors (Belecina, & Ocampo, 2018; Benedicto & Andrade, 2022). In the latter, students learn how to comprehend writing strategies and figures of speech that might otherwise keep them from understanding deeper messages in text; understand character development and the logic of a story's trajectory, so that they can assess social norms using evidence while learning to examine their own biases; recognize when their own thinking is flawed, and why; and relate their own experiences to the text and therefore reflect on the meaning of both the text and their experiences (Hayes, 1990; Taguiam, 2022).

Marquez (2017) however, takes a different stance on the issue of criticality: rather than approaching critical thinking from its literal application of fact-checking and belief examination, critical pedagogy is put forth as a way to assess truths on the basis of where they fit within the power structures of society. While critical thinking is about transforming a false claim into truth, critical pedagogy is about transforming the flows and relations of power in society as a whole.

4. The Philippine Context

The Philippine education system is in dire straits: the country ranks extremely low on international standardized tests, as well as local tests on critical thinking capacity (Taguiam, 2022). An overwhelming majority of students does not have the skills for living in modern society, such as grasping the basics of math and science (Basillote, 2022). Education experts claim that low reading comprehension could have led to these low scores (Brazel, 2020); and that the low mathematics scores could also have come from low scores on critical thinking indices, both by students and the teachers tasked to instruct them (Benedicto & Andrade, 2022).

It was this faulty educational system that became an issue in the 2022 presidential elections, where misinformation spread rapidly, and with very little objection from the voting population; pundits, however, also point to the 2016 elections, when people simply wanted a messiah to save them, and elected a strongman while believing all the propaganda about him (Marquez, 2017).

The period between 2016-2022 was a turbulent one for the Philippines. Those who dared to question government policies were often lambasted by government apologists, who also "red tagged" dissenters by associating them with Communist insurgent rebels (IBON Foundation, 2018). The police force, in particular, called for schools to stop teaching rebellious ideas, but with no qualifications for what this meant – this led to a chilling effect across universities and the press, which curtailed the transformative power of education (IBON Foundation, 2018).

Historians, however, believe that the roots of the problem go even farther back, to the time of colonization – especially during the American occupation of the early 1900s, where widespread education meant standardized education, which also meant rote memorization (Dela Cruz, 2012). This colonization created a classroom that became a closed system rather than a microcosm of reality, and this closed system is a problem that persists to this day. While the country is literate, the skills taught in school are taught in English, which is a language few students learn at home; local knowledge and culture are also left out, so that students view school as a mere steppingstone,

and classroom skills as inapplicable in the real world (Tupas, 2003). One of these skills, critical thinking, then becomes a mere classroom exercise rather than a skill to be used throughout one's life.

The recent elections are merely a culmination of years of misinformation, disinformation, historical distortion, and deception by a government that has returned the Marcoses to power. In this last decade, historians have been labeled as gossipers for spreading information on how the Marcoses violated human rights during their first term in office; columnists, pundits, writers, and intellectuals have been lambasted and mocked for being out of touch with the poor, and for supporting supposedly elitist candidates; and well-qualified candidates have been derided online, while those who have no credentials (or worse, fake ones) have been lauded, and now have prominent government positions.

Today's educational system is mixed. Some international schools based in the country employ critical thinking techniques, such as problem-based learning, collaboration, and inquiry (Enderun Colleges, 2018). In most schools elsewhere, teachers are trained to follow outcomes-based education, which heavily relies on Bloom's taxonomy, but with no guarantee that critical thinking can be achieved, let alone assessed. Education focuses largely on skills training to prepare students for the workplace, and critical thinking is taught exclusive to some courses, so that the illusion is created that only some professionals require it while others do not (Marquez, 2020).

Some researchers have recommended new techniques to both improve the educational system as well as to increase critical thinking in a population that has often been nicknamed as "ground zero" for the ill effects of social media. Some researchers call for a more critical approach to pedagogy, where classroom instruction critiques the social structures that lead to certain beliefs rather than memorizing what those beliefs are absent of connections to society at large (Marquez, 2020). Other researchers also recommend that education should be free and compulsory, so that parents are penalized if they do not keep their children in school; but that the system has to be more discerning, so that students cannot move through grade levels without concrete demonstration of their mastery of basic skills, such as reading comprehension (one of the foundations of critical thinking) (Basillote, 2022).

Critical thinking is now a necessity in the Philippines. The next generation needs to be more strongly equipped with tools to think systematically, and to look beyond the glamor of the online arena.

The researcher belongs to the department of Communication at a Jesuit University, and practices Ignatian pedagogy, as prescribed by Jesuit education. Ignatian pedagogy demands that teachers first come from the learners' perspective, rather than lecture topics outright. Students must first be allowed to speak their minds, after which they can be oriented into the topic, so that discussion can follow and allow the students to place the topic being studied somewhere in their lives. This would ideally form the basis of critical thinking, and in its most ideal form, help students attain critical thinking in the classroom that can help them critically appraise the "real world". However, the researcher has observed that students are far less focused on critical thinking and more so on attaining grades, so much so that discussion is often interrupted by the question of, "Is this correct?" or "What is the correct answer?"

Nevertheless, the researcher has persisted in encouraging a discussion and exchange in every class, and used a framework that would allow the students to appreciate critical thinking as part of the habits of a specific culture.

5. Merton's Norms of Science

One way that students might be acquainted with critical thinking and its context is through examining how scientific, systematic thinking is carried out. Students might be taught about the scientific method, but this method simply represents the many methods that scientists use to carry out systematic research. For example, not all research begins with a hypothesis, nor does all research go through methods and then analysis in a single, seamless process. Often, science has to

replicate work, salvage experiments with bewildering (or no) results, and, in the case of social science, change frameworks halfway because of new, emergent data.

Whatever the process, science operates on thinking systematically, of working step by step. Critical thinking, in this case, however, works within a much larger scientific culture. This step-by-step thinking is consistent with the expected behaviors of scientists as a group.

Robert K. Merton, an American sociologist, formulated the norms of science in the mid-20th century as a way to describe how scientists carried out their work. His research was set against the background of the Second World War, where scientists were called to service on both sides of the globe, which gave rise to the question: should science take sides?

Merton's norms are ideal, desired behaviors of scientists (Anderson et al., 2010; Bray & von Storch, 2017). Merton also proposed counter-norms, which act as check and balance to the scientific enterprise, so that scientists can recognize when their norms are being violated and can therefore impose appropriate sanctions (Anderson et al., 2010). Merton's norms might be nearing a century old, but they can still be used today to understand why scientists behave in certain ways, why some aspects of science are difficult to communicate, and why critical thinking is a way of life for professionals in a specific field rather than an abstract way to view the world.

Merton described 4 norms and their counter-norms:

1. Communism (now written as communalism): good science is that which scientists share to all, so that it can be a part of the general pool of knowledge. This also refers to the common ownership of knowledge, because research is collaborative (Anderson et al., 2010). The counter-norm, secrecy, is a critique of scientists who do not release their results or work with no regulatory mechanisms in place.

Recent research shows that in the academe, communism is still supported because materials are shared with no regard for intellectual property and copyright (Macfarlane & Cheng, 2008) but climate change scientists are now more concerned about data privacy and ownership, and choose to withhold their results until they have been published (Bray & von Storch, 2017). Recent developments in publicity, including social media, might also facilitate the spread of scientific information – but this might be dangerous if the information has not yet undergone peer review, or has not yet been verified (Hogan & Sweeney, 2013). Care must be taken in interpreting Merton, however: research findings should not simply be released without being replicated, critiqued, or verified, which is consistent with the rest of the norms.

2. Universalism – this norm proposes that academic knowledge should not be bound by national, political, or religious beliefs (Macfarlane & Cheng, 2008). Information should not be evaluated depending on who says it, but whether it contributes to knowledge (Anderson et al., 2010). Recent research has shown that this norm is slowly losing its practice, especially for climate scientists, who tend to judge a work's significance based on who wrote a paper, rather than on what it contains (Bray & von Storch, 2017). This is dangerous, as it might exclude well-written, well-executed research that is written by lesser-known authors, while favoring any work, regardless of quality, by someone who enjoys wide popularity within the scientific community. This behavior actually describes the counter-norm: particularism.

3. Disinterestedness – this norm proposes that scientists must be personally detached from knowledge: scientists must work because they have to help society, not because they want to enrich themselves (Anderson et al., 2010; Macfarlane & Cheng, 2008). As funding becomes an issue, however, some scientists today now choose to align their research with the interests of those who can give them money to fund research (Bray & von Stoch, 2017; Macfarlane & Cheng, 2008). This behavior actually describes the counter-norm: interestedness.

4. Organized Skepticism – This is one of the most popular and well known norms, and is hardly ever tested because it represents scientific work. Researchers must scrutinize research findings according to logic, and suspend all their judgement until findings are completely evaluated and replicated (Anderson et al., 2010). The counter-norm is dogmatism.

Merton's norms have been debated and disputed since their inception. Recent surveys and discussions among scientists show that not all the norms are supported (Anderson et al., 2010;

Macfarlane & Cheng, 2008). This limited support is understandable, since Merton's paradigm was that of isolated science that was not expected to participate in debates (Macfarlane & Cheng, 2008). The norms, therefore, might be ideals rather than prescriptions, or expectations of good behavior rather than actual behavior among scientists (Anderson et al., 2010).

There, too, might be new norms. Anderson et al. (2010) propose adding governance vs. administration, where scientists should be held responsible for the conduct of science rather than be beholden to administrators who over-regulate their work; and quality vs. quantity, where the published work of scientists must be judged not on their density but on the quality of even a few works produced.

While Merton's norms are judged as outdated, they can provide a framework to understand the culture of science (Bray & von Storch, 2017), and can perhaps help students see how critical thinking operates within a paradigm, rather than as an isolated task to be carried out.

6. Applying Merton's Norms for Critical Thinking in the College Classroom

Merton's norms do more than represent the ideals of science. They also show the infrastructure around which critical thinking can operate. Communalism shows that knowledge is everywhere and should be used by all as a way to appraise the world. Universalism dictates that knowledge be examined first for its merits rather than who produced it. Disinterestedness claims that all thinkers should love the process of learning rather than concentrate on its output. Organized Skepticism encourages a questioning spirit, and advocates for tentativeness rather than outright acceptance of knowledge once it becomes available. These characteristics are consistent with how critical thinking has been described in previous literature (Behar-Horenstein & Niu, 2011; Kumar & James, 2015; Lloyd & Bahr, 2010)

The norms show how critical thinking can operate within a scientific culture – and at the same time, they are the welcoming gates into scientific thinking. Scientists do not have a monopoly on knowledge, critical thinking, and questioning. Rather, all students – and all humans, for that matter – should exercise critical thinking as a way of life for all fields.

This researcher has used the norms of science as a framework, both explicit and implicit, in tertiary-level classes. In these classes, Merton's framework serves as a way for students to appreciate that critical thinking is not confined to the classroom. It is no mere tool to be abandoned when class is dismissed. Rather, it is a cultural practice that allows students to both question themselves while learning how to improve themselves. This use of the norms of science, in setting critical thinking against the practices of a culture, is consistent with Ignatian Pedagogy, which stresses on teaching about and within context.

6.1. Qualitative Approaches in Communication Research [COMM 194]

Qualitative Approaches in Communication Research is one of two required research classes in the Department of Communication's roster of required undergraduate courses for its majors. Students take this in their choice of semester in their Junior year, after they have taken theory classes and electives, and as preparation for thesis work. In this class, the students learn how to conceptualize research, implement it, analyze and discuss data, and present their work.

In COMM 194, the researcher teaches students to conceptualize qualitative research from paradigms, to theoretical approaches, to theory, all while integrating context, and using this conceptualization to dictate the choice of methods and the strategies in discussing the results later.

To encourage Communalism, students are required to substantiate their claims with peer-reviewed sources. To foster Universalism, students are required to examine a chosen communication issue from a variety of paradigmatic angles, and then theoretical approaches, and then methods, all to drill in them a systematic process of examining communication phenomena. To push for Disinterestedness, students are enjoined to examine their roles as researchers by disclosing why a study is relevant, significant, and important, but also to admit their own pre-conceived opinions about an issue, as is fitting for qualitative work. Finally, students are trained to

practice Organized Skepticism throughout the semester, as they question all their choices, critique previous research, and systematically analyze their findings.

Critical thinking arises from these exercises, but should be manifest when the students are able to produce their proposals, and then gather and analyze data within the semester. They are constantly prodded to think before they make conclusions, to look at their work against the findings of previous research, and to appreciate that they have expertise to contribute to the growing world of communication research.

This class was first offered online in 2020, and is now being offered onsite. Online, students were able to produce strong proposals that successfully linked theory and methods; however, the students had already forgotten their theory lessons, as well as the early admonitions to never forget their theory classes. They found the start of the class difficult, but as they were drilled constantly on their ability to think conceptually, and as they were forced to create proposals and implement research, they also produced good research.

Onsite, the students are still adapting to the face-to-face mode of delivery, and are therefore struggling to meet the strict deadlines of the course while trying to incorporate their knowledge of theory. As with the online students, the students in the onsite course found it more difficult to connect theory with conceptual thinking about the world, as well as with logical methods choices. They also could not read long texts for long periods of time; and when they tried, they could not read efficiently enough to absorb and apply what they read. The researcher, therefore, had to drill the students more frequently so that they could establish connections among their classes in preparation for gathering data.

6.2. Science and Risk Communication [COMM 24]

Science and Risk Communication is a required class in the Department of Communication's roster of required undergraduate courses for its majors. Communication Majors take this in their 2nd Semester of their Junior year, after they have taken classes in theory, creativity, social change, and research. This class is a culmination of years of coursework and is the main bridging class into the senior thesis. In this class, students learn how to conceptualize both research and research-based projects in science and risk communication, write them into formal proposals, and defend their work. Students who major in Life Sciences, with a specialization in science communication, also take this class as their research class in preparation for capstone work.

In COMM 24 the researcher teaches students to critically approach science and risk communication, not as mere tools to "reach out to the lay public", but as pathways to first understanding the many and diverse publics that must deal with science and risk on a daily basis. This class is a research class: students are required to examine various natural hazards unique to the Philippines, and to propose research and a research-based project for each natural hazard, unique for a specific public.

To push for Communalism, students are required to critique their own assumptions about their specific publics and the role of science in people's lives by critically examining what they think they know about science communication, and then reading peer-reviewed research to see how their assumptions are likewise critiqued in the scholarly literature. To encourage Universalism, students have to cater to a new public each time they have to deal with a new hazard, so that they can see that every voice matters when issues must be resolved. To train for Disinterestedness, students are required to critique local communication projects using the philosophy of scientific practice, rather than opinions based on faulty assumptions. Finally, to bring forth Organized Skepticism, students produce detailed capsule proposals that will allow them to both identify problems that have been thought as solved, and provide their own research or project to address the problem.

Critical thinking should arise from these individual exercises around the norms, but they must be manifest at the end of every module, as students submit their proposals – which are the product of critically examining a problem, proposing solutions based on research, and then justifying each step of their proposed work. At the end of the semester, students have to present their best

proposal and defend their choices, allowing the class to critique each other in a congenial atmosphere.

This class was first offered online in 2021. Online, students were able to produce strong proposals, both research and project, only after they were able to go through several modules and were at last used to the process of systematic thinking and brainstorming. They complained about short deadlines, but in the end – and in exit interviews with the department – they admitted that the class had organized their thinking and helped them understand the process of communication as tied to research. More details about the conceptualization and execution of this class can be found in this author's previous research (Ponce de leon, 2024).

6.3. Communication Thesis [COMM 199.1] and Defense [COMM 199.2]

The Thesis and Defense classes are taken in the communication major's final year in university. The students can choose to work on their thesis individually, or in groups of 2 or 3 people. In an echo of COMM 24, this class allows students to choose between carrying out a research thesis or a project thesis; in either case, students' work must be based on sound social sciences theory and methodology. Throughout the year, the students work under an adviser who guides them through the process of conceptualizing research, gathering and analyzing data, implementing and evaluating a project, defending their thesis, and documenting their work.

The researcher advises students, and pushes them to exercise critical thinking throughout the entire process.

To foster Communalism, students are required to justify every step of the research process using previous research and theory as their base. To encourage Universalism, students must choose a topic that they are both familiar with and interested in, but they are constantly questioned about their choices in terms of methods and theory – and their responses must be systematic, organized, and backed by research. To spur Disinterestedness, students are required to disclose all their financial and intellectual stakes in the research, subject their proposal to the gauntlet of Ethics Review, and go through a Thesis Defense that tests their ability to stand their ground while critiquing their work. Finally, the students learn Organized Skepticism as their default position during each semester of thesis work: they must neither over-generalize nor over-claim depth, discuss the implications of their work in terms of how their methods could have contributed to the nature of their findings, and openly admit – both in their defense and on paper – where their work could have been improved or could have gone wrong.

The whole act of thesis writing and defending is an exercise in critical thinking, and the varying framework-based skills root it in a context. The students learn how to consolidate all their knowledge, to see what is needed and what is missing, to propose and execute research, and then to work through the process logically while admitting where they are unable to control mishaps or extraneous variables.

This class was first offered online in 2020, and is now being offered onsite. After being subjected to the rigor of two major research classes and COMM 24, the students were more organized in their thinking, and could defend their work using concepts from theory rather than mere opinion or speculation. The students found it difficult, whether online or offline, to sustain their energy, especially if there were natural calamities (such as storms and flooding) that disrupted their schedules. Online, the students were mixed in their response: some would not show up to consultations; others would be extremely invested in the process. Onsite, the students were more focused: they pushed for early submissions, consulted constantly, were unafraid to ask questions, and were even unafraid to offer reasoning for their methods decisions.

6.4. Basic Belly Dance [PHYED 153]

The researcher also teaches Basic Belly Dance for the Physical Education Program of the university. Students at the university are required to choose 4 PE subjects, each of which must be taken in a semester of their first two years of college. PHYED 153 is one among as many as thirty other physical education classes, and is open only to female students.

While this might seem an unlikely place to learn critical thinking, PHYED 153 is actually the best medium to teach it: belly dance has suffered for its reputation as a dance meant only for seedy bars and hidden clubs. Belly dance, however, is a dance with roots that go back to older folk dances in the Middle East, North Africa, and Turkey; it has also evolved into varying sub-genres, and is constantly changing and reflecting the context in which it is practiced. To acknowledge this cultural richness is to allow students to critically examine how a dance can speak volumes of the culture from which it arose, as well as the audiences to which it apparently caters.

To spur Communalism, students first receive an orientation on Belly Dance as a cultural vehicle, and examine its history as a constantly evolving dance with distinct cultural, geographical, and stylistic nuances. To push for Universalism, students are taught individual dance steps, along with their origins, muscles to access and control, and music to match, as a way for them to see dance as a systematic process of creation that is as much art as it is science. To encourage Disinterestedness, students are drilled constantly on musicality – or the ability to make a dance movement match the texture of the music – so that they can see how the steps depend on the music, not on some abstract form of eliciting desire. Students are, moreover, constantly asked about which muscles are moving, which muscles should remain at rest, which moves are difficult to control, which are easy to execute – all in a bid to show the students that their bodies are all different, and that they bring their own knowledge and emotions to the dance. Finally, students are encouraged to practice Organized Skepticism, as they are required to push themselves by dancing solo for longer periods of time during quizzes, until they have enough confidence to dance solo – a process that makes them question their own biases and inner discouragement. They are also invited to be honest about their own shortcomings as dancers while looking at their strengths, again to make them see themselves as owners of their bodies rather than mere participants in a class.

Critical thinking is exercised in every session, therefore, and is rooted in the Mertonian framework as practiced in the class. Students are invited to examine the strength of their bodies, as well as the control required in belly dance, which would render the dance anything but indecent. They are also invited to critique performances, and to see the art form not as mere titillation, but as history that is constantly reshaped by the context in which it is performed.

This class has been offered since 2012, first onsite; then online for two years during the pandemic; and then onsite once again. Regardless of the mode of delivery, students have been watchful about their movements, and know how to critique dances using a vocabulary that encompasses control of movement and posture, rather than sensuality and mere size of the steps. The students have also reported that they felt more in control over their bodies, cognizant of their individual strengths rather than those demanded of them by society, and even able to teach their relatives to dance using techniques that strengthen the body rather than force it into movement.

7. Discussion of Merton's Framework as Practice

The researcher's students have long been immersed in an atmosphere of curtailed free speech (IBON Foundation, 2018) and come from secondary school systems that have the reputation of not doing well on standardized tests due to a weak grasp of basic mathematics, reading, and science skills (Basillote, 2022; Brazel, 2020). They are also social media natives, and they require tools to help them critically examine the world in which they were raised so that they can recognize right from wrong, truth from falsity, and good from evil. They need critical thinking skills that include discernment, awareness of the inner workings of social media, and even how the world of knowledge acquisition and research operate (Brookfield, 2015; Hogan & Sweeney, 2013; Indrasiene et al., 2021; Kraus et al., 2013).

The researcher therefore infused all her classes with critical thinking set against the Norms of Science, so that the students had a context against which they could confront their assumptions about the topic at hand, whether it was belly dancing or research, science communication or a complete undergraduate thesis. Assumptions about knowledge and practice can cloud their reason (Brookfield, 2015) and keep them from getting new ideas, or even exercising curiosity and

creativity. This technique of teaching the same critical thinking skills, but with scaffolding of subject matter knowledge and specific practical cases, is consistent with recommendations of Bellaera et al. (2021). While this method is not a strictly explicit way to teach critical thinking, it is nevertheless taught as a habit, as it were, arising from the norms of science – providing a layer of practice rather than a template that students have to simply read and follow, which is consistent with recommendations from previous literature (Behar-Horenstein & Niu, 2011; Bellaera et al., 2021; Fernandez & Padilla, 2020; Franco et al., 2017; Motz et al., 2022; Mulnix, 2012; Taguiam, 2022).

While researchers have debated whether critical thinking can be measured, effort should nevertheless be placed in trying to teach it in the classroom using methods that might have been tested before. For instance, the researcher's research and science communication classes involved debate, dialogue, and discussion of real-world problems (Abrami et al., 2015; Alwehaibi, 2012; Bellaera et al., 2021; Benedicto & Andrade, 2022; Hayes, 1990; Kraus et al., 2013; Peach et al., 2007), which is consistent with the norms of Organized Skepticism and Communalism. That is, science is constantly negotiating knowledge by making it available to all, and by questioning new information. These are habits that can be formed in the classroom and, hopefully, carried out to the real world. The researcher also helped students exercise Universalism in their research, science and risk communication, and thesis classes, where they were all tasked to read the literature and critique both previous research and previous communication projects regardless of the experts who had produced them (Anderson et al., 2010; Lloyd & Bahr, 2010).

In all her classes, the researcher has also found that critical thinking is best taught when it is contextualized and practiced (Behar-Horenstein & Niu, 2011; Bellaera et al., 2021; Fernandez & Padilla, 2020; Franco et al., 2017; Motz et al., 2022; Mulnix, 2012; Taguiam, 2022) even if the activities, let alone the class, were not explicitly labeled as critical thinking. This was most evident in the Science and Risk Communication class, where students were given the chance to target specific audiences by identifying their specific problem in a specific hazard situation. This was evident even in the Belly Dance class, where students were given the chance to choreograph their own dances in keeping with the form and traditions of the dance.

The norm of Disinterestedness, however, was confined to classroom teaching, as the students could not always pursue their interests with zero bias. The thesis students had to worry about their own funding limits, the research students needed to align their research with what could be done in class, the science and risk communication students had to keep in mind the infrastructure that could be available to them should the research or project indeed be carried out, and the belly dance students had to contend with the limits of their own bodies in terms of weight, mobility, and flexibility.

8. Conclusion

Critical thinking is a requirement for all persons in an age of social media driven by myths and fantasies. Students need to be drilled constantly in applying critical thinking by knowing fact from fiction, how social media can drive the creation of both echo chambers and falsehoods, and how to get more information before liking or sharing what they see (Brookfield, 2015; Indrasiene et al., 2021; Kraus et al., 2013).

Critical thinking is both difficult to define and assess, but teachers have tried to do it using a variety of methods, including debate and discussion, as well as deep dives into literature and research (Abrami et al., 2015; Alwehaibi, 2012; Bellaera et al., 2021; Benedicto & Andrade, 2022; Hayes, 1990; Kraus et al., 2013; Peach et al., 2007). In this paper, the researcher applied the framework of Merton's norms of scientific practice, which include Communalism, or the common ownership of scientific knowledge; Universalism, or the common critique and transparency of scientific practice; Disinterestedness, or the pursuit of science for common good rather than selfish ends; and Organized Skepticism, or a default position of questioning rather than outright acceptance of so-called facts (Anderson et al., 2010; Bray & von Storch, 2017).

The researcher applied these norms as a way to make critical thinking stand against both practice and culture in the college classroom. These norms were applied to classes in Qualitative Approaches in Communication Research, Science and Risk Communication, Communication Thesis and Defense, and Basic Belly Dance. In all these classes, the researcher found that contextualization via both the norms and current problems allowed critical thinking to bear fruit. In particular, the researcher organized activities along the lines of discussions about the nuances of real-world problems and how to solve them systematically, role playing, critiquing media and popular representations of an issue, interactive learning, and brainstorming, consistent with activities in previous literature (Abrami et al., 2015; Alwehaibi, 2012; Baylon, 2014; Bellaera et al., 2021; Benedicto & Andrade, 2022; Enderun Colleges, 2018; Fadhlullah & Ahmad, 2017; Hayes, 1990; Kraus et al., 2013; Motz et al., 2022; Peach et al., 2007).

However, the students were sometimes hampered by lack of training and rigor in previous courses. As in previous research (Benedicto & Andrade, 2022; Fadhlullah & Ahmad, 2017; Dela Cruz, 2012), they were comfortable with lecture-and-exam classes and were reticent, at first, when made to think, reason, and create on their own. As the semester progressed, they nevertheless were able to adapt to the challenges of their respective courses. This shows that both domain-specific knowledge and general critical thinking skills are needed, in tandem, to foster an atmosphere of critical thinking in the classroom. Despite some research challenging the notion, critical thinking skills can be transferred across knowledge domains (Bellaera et al., 2021; Liu et al., 2014; Motz et al., 2022; Mulnix, 2012) because they rest upon a culture of systematic thought, rather than knowledge per se.

While Merton's norms are sometimes judged as outdated, they nevertheless provide a framework to understand science as practice, and can be the contextual backing that shows how critical thinking operates within a paradigm rather than as a mere task to be carried out and fulfilled. Other subjects can use this framework to structure instruction, foster an air of healthy debate, and encourage critical thinking. In the process, students can learn to question previous assumptions they might have of reality and social phenomena, and, as a consequence, find innovative ways to solve and/or investigate social problems.

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