

Getting it to Click: Students Self-Perceived Critical Thinking Style and Perceptions of Critical Thinking Instruction in Face-to-Face and Online Course Delivery

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Abstract

In higher education today there is a high demand for online education, but what is the price paid for making that transition? The purpose of this study was to examine the foundational differences between critical thinking instruction face-to-face and online. Students enrolled in a face-to-face course and students enrolled in an online course were asked to evaluate their self-perceived critical thinking style to compare changes in development between the two modes. Additionally, students were asked to evaluate the extent to which they perceived the instructor to emphasize critical thinking as part of the course instruction. The study, which took place from fall 2011 (face-to-face) to summer 2012 (online), showed that students in an online environment showed greater gains in “seeking” behaviors than their face-to-face peers. However, both groups showed that there was a high level of support for the course instruction emphasizing critical thinking.

Introduction

In today’s higher education environment there is an increase in the demand for instructors to transition traditional face-to-face courses to online delivery (Astleitner, 2002). Ultimately, the challenge becomes maintaining the integrity and rigor of course instruction across different modalities. This can often be overwhelming, time consuming and a perceived barrier to faculty. With broad concepts like critical thinking the means by which a faculty builds student capacity can greatly differ between traditional face-to-face instruction and online delivery. However, faculty wants more than anything to maintain the consistent outcomes of instruction regardless of the delivery method.

“It seems reasonable to suggest that critical thinking ability is one such enduring skill, that it is a central element in lifelong learning and that it is an appropriate skill for colleges and universities to develop among students”

(Terenzini, et al., 1995, p. 24). Critical thinking has long been a crucial element in higher education curriculum. A National Institute of Education report in 1984 concluded, “A college education should enable students to adapt to a changing world and that successful adaptation requires ‘the ability to think critically, to synthesize large quantities of new information’” (as cited in McMillan, 1987, p. 3).

University faculty are responsible for increasing content knowledge, in addition to increasing students’ skill set. Though students may not retain most of the information digested during their college careers, the critical thinking component is one that will remain for the future. For this reason alone, great emphasis is, and must be, placed upon the initiation and/or development of a student’s critical thinking style and capability.

Further, MacKnight (2000) reported that critical thinking goes well beyond just how an individual thinks and affects communication in various forms. This goes beyond course instruction and can be practiced daily. In many online environments this level of critical thinking development occurs in online discussions, including web-based chats, discussion boards and email (MacKnight, 2000).

“While common sense and the experiences of hundreds of college professors suggest that attending college results in improved critical thinking of students, there is little research reported here to suggest how such improvement takes place” (McMillan, 1987, p. 11). Vast research, including McMillan’s (1987) comprehensive study review, has been conducted regarding the enhancement of college student’s critical thinking abilities. One way to improve critical thinking is through classroom teaching. *“It has been assumed that if teachers use appropriate instructional methods and curriculum materials, students will improve their critical thinking skills”* (Young, 1980) (McMillan, 1987,

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p. 4). Furthermore, it is concluded that smaller classes with a student-centered, discussion emphasis are most effective (McMillan, 1987, p. 4).

Furthermore, Daly (1990, as cited in Shafersman, 1991) postulated that employers identify with the nature of critical thinking as a means for increasing the United States market in a global economy. This perception of employers is not just limited to global markets, however in the 2006 publication, *Are they really ready to work?* Nearly 92% of employers ranked critical thinking and problem solving as very important, yet only 26% ranked recent graduates' critical thinking and problem solving skills as excellent. This has created a concern that higher education is not producing graduates with the basic skills sets to be successful in the workplace.

More recently, the Association of Public and Land Grant Universities (APLU) in a partnership with the University Industry Consortium (UIC) completed a study, which provided insight into the perceptions of alumni, faculty and industry employers about the soft skills necessary for success. Crawford et al., (2011) showed that by majority, employers and students alike placed effects of decisions within their top three skills of the decision-making cluster. Additionally, the top two for all groups were: 1) Identify and analyze problems and 2) Take effective and appropriate actions.

Faculty are encouraged to develop critical thinking through the use of specific pedagogical tools including: asking the right questions, listening, sharing work, building on others' ideas and constructing understanding. While this list is not exhaustive, it does present a challenge of how these tools can and should be used.

In order to fully understand the implications of these perceptions a further examination of the literature related to critical thinking and online instruction is necessary.

Theoretical Framework and Literature Review

The theoretical framework driving this study is Beyer's (1987) model for how best to teach thinking. Beyer's framework includes six stages: 1. Introduction, 2. Guided practice, 3. Independent application, 4. Transfer and elaboration, 5. Guided practice and 6. Autonomous use. Beyer argues that any thinking skill can be learned with a high level of proficiency when that skill proceeds through all six stages. The following brief definitions outline each of the six stages:

- Introduction – the initial instruction related to a specific thinking skill, usually a single lesson.
- Guided practice – lessons in practical execution of the skill with instructive guidance.
- Independent application – repeated opportunities for students to practice the skill on their own.
- Transfer and elaboration – shows students how to apply previously learned skill to a new setting.
- Guided practice – repeated practical execution in the new setting.
- Autonomous use – students demonstrate ability to use thinking operation on one's own.

Beyer (1987) further elaborates that the teaching of thinking will be useless unless the appropriate teaching strategies are used. "Establishing and maintaining a structure that facilitates the teaching and learning of thinking is extremely important to improving student thinking" (Beyer, 1987, p. 83). For the purposes of this study the following framework guides the use of critical thinking as the specific thinking skill or strategy of interest.

Critical Thinking

For more than 20 years, researchers have been fascinated by the nature of critical thinking. This has been a developing concept in higher education since 1990 when Peter Facione challenged colleagues to define critical thinking through a Delphi study. The resulting work defined critical thinking as "*purposeful, self regulatory judgment which results in the interpretation, analysis, evaluation and inference as well as the explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which judgment is based*" (p. 2). Rudd et al., (2000) furthered this concept citing that critical thinking is a "*reasoned, purposive and introspective approach to solving problems or addressing questions with incomplete evidence and information for which an incontrovertible solution is unlikely*" (p. 5).

In higher education the emphasis has often been on the measureable outcomes associated with skill development. This has resulted in a narrow focus of critical thinking and contributed to a skewed view characterizing it as an assortment of skills rather than a complex and intentional process allowing for individuals to make reasoned and judicious decisions (Paul, 1990). Within Facione's (1990) Delphi it was suggested that an individual has two facets of critical thinking: disposition and skill. Together, the two factors provide educators with a much more holistic understanding of critical thinking. Over the past decade academics have increased attention to the dispositions of critical thinking as a means for developing students' capacity for critical thinking (Ennis, 1991; Esterle and Clurman, 1993; Facione and Facione, 1992; Paul, 1990; Siegel, 1988; Tishman and Andrade, 1996).

Critical thinking disposition has been characterized as the consistent internal motivation to engage problems and make decisions by using critical thinking (Facione, et al., 1996). Disposition refers to a habit or tendency an individual has toward critical thinking. Facione (1990) refers to the dispositions as "characterizations of good critical thinkers" (p. 11). One recommendation of the Delphi (Facione, 1990) is to develop instructional tools, which cultivate the dispositions, which can in turn lead to the use of critical thinking skills beyond an instructional setting. Ricketts and Rudd (2004) describe three dimensions of critical thinking disposition: Cognitive Maturity, students' predisposition to looking for opportunities to use reasoning; anticipating situations that require reasoning; and confidence in reasoning ability; Engagement, students' predisposition to be

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intellectually curious and desire to know the truth; and Innovativeness, students' predisposition to being aware of the complexity of the problems; being open to other points of view; and being aware of their own and others biases and predispositions. (p. 24)

Recently, the University of Florida has created a synthesized version of critical thinking focused on style instead of disposition or skill. The University of Florida Critical Thinking Inventory (UFCTI) is the resulting instrumentation, which addresses an individual's perceptions of their personal critical thinking style. Style is measured on a continuum of Engagement Style and Seeking Information Style (Lamm and Irani, 2011). Individuals who possess an engagement style are often aware of their surroundings and are able to anticipate situations where reasoning will be required. They are often confident in their reasoning ability and enjoy solving problems and making decisions. On the opposite spectrum, those individuals demonstrating the seeking information style are considered "hungry learners" and are often looking for new knowledge and information. They are capable of seeing the world as complex and are aware of their own biases and predispositions (Lamm and Irani, 2011). Together, these two styles represent the breadth of critical thinking style that individuals may express.

Critical Thinking Instruction

Smith (1981, as cited in Machemer and Crawford, 2007) concluded that three specific teacher behaviors significantly improved students' critical thinking. Those behaviors are supporting the student; include student participation during class sessions and building relationships with students in the course. Today's active learning techniques encourage the goals and objectives of higher education and help students understand diverse and differing viewpoints and ways of knowing, in addition to fostering cross-disciplinary interactions (Machemer and Crawford, 2007).

To encourage this type of teaching more student-centered approaches are necessary. Historically, teacher-centered teaching referred to a lecture based approach whereas student-centered teaching involves an active and/or cooperative learning process. Active learning does not disregard the lecture approach entirely, but it encourages the inclusion of individual and group application during class. Jungst et al. (2003), Johnson et al. (2000) and Millis and Cottell (1998) noted, "*Research has reported on the values of active learning, including the opportunities and the challenges from a teacher and institutional perspective*" (as cited in Machemer and Crawford, 2007, p. 10).

However, research on student perceptions of active learning opportunities and settings is limited and contradictory (Machemer and Crawford, 2007). Machemer and Crawford (2007) researched students' value level regarding active, cooperative and traditional teaching methods. Active teaching is student participation in class where cooperative learning is student participation with

other students. High achieving students were the most reluctant concerning cooperative learning techniques because they are comfortable and successful under the teacher-centered course structure (Felder and Brent, 1996; Peterson, 2004). Machemer and Crawford (2007) found that students want to take an active approach to learning but they do not want to be responsible for their peer's learning. These results can be accredited to the fact that students are very accustomed to the well-established lecture style teacher and prefer their obscurity in the classroom to interactive learning.

Other factors to consider when analyzing a student's critical thinking style and abilities are, peer influence outside of the classroom, student demographics and study habits. "*Even with precollege critical thinking controlled, students' out-of-class experiences contribute as much to gains in critical thinking as did students' class-related experiences*" (Terenzini, et. al., 1995). Students with more competition-oriented friendships make more significant gains than those with supportive, coddling friends.

Also, the number of hours students spent studying and the number of non-assigned books students read during the year were all significantly and positively related to first-year gains in critical thinking" (Terenzini, et. al., 1995, p. 34). "*Huxham (2005) noted 'student evaluations, on their own, do not provide sufficient grounds for changing teaching practice...what students want may not be what is pedagogically best'*" (p. 27) (Machemer and Crawford, 2007).

Critical Thinking Instruction Online

Current research on critical thinking in the online educational environment has focused heavily on methods to support critical thinking with less attention to the cognition behind critical thinking. Several studies examine a particular method or approach to fostering critical thinking in the online classroom and identified practical applications for professors and instructional designers (Barber, 2011; Carter and Rukholm, 2008; Chann-Ru, 2012; Frey, 2011; Kurubacak, 2007; Pena and Almaguer, 2012; Richardson and Ice, 2010; Sharma and Hannafin, 2004). A synthesis by Maurino (2007) found contradictory findings in the literature on critical thinking skills in online discussions and listed alternative methods (e.g. group work, case studies and problem based learning activities) to achieve these instructional goals. While these approaches provide a wide variety of best and worst practices for developing critical thinking skills online, we turn to how students' perceptions influence their performance on these tasks.

The research that examines individuals' perceptions in the online learning context has demonstrated a connection between personal satisfaction and self-concept with performance of critical thinking skills (Hamann, 2012; Wang and Pei-Yi, 2008; Yang and Chou, 2008). Of particular interest in this line of inquiry is the work of Wang and Pei-Yi (2008), which found that self-efficacy predicted student use of critical thinking

strategies and students with high self-efficacy used more high-level strategies. Exploring this connection between self-perception and its impact on the quality of thinking and learning skills is truly important when considering the student in designing instruction.

The challenges for instructors to build capacity for critical thinking then must become two fold, instructors must appreciate the natural critical thinking style of students, but also the impact of the extent to which specific strategies are utilized to encourage critical thinking. Understanding has to be in tandem, instructors must be explicit in exploring both how students think critically and the quality of their instruction.

Purpose

The purpose of this study was to determine if a student's self-perceived critical thinking style influenced his/her perception of critical thinking instruction examining both face-to-face delivery and online delivery. The objectives of the study set forth to guide this study were to determine:

1. Critical thinking style of students as identified by the UFCTI,
2. Change in critical thinking style of students as identified by the UFCTI and
3. Students' perceptions of the extent to which critical thinking was taught in the course.

Methods

This study was conducted as part of a course evaluation process designed for the Scholarship of Teaching and Learning (SoTL). The survey research methodology utilized three short questionnaires to assess students' critical thinking style, evaluation of the course (critical thinking emphasized) and demographics. This was a non-experimental causal comparative design. The face-to-face course took place during the fall 2011 semester and the online instruction was during the summer 2012 semester at a large land grant institution in the south. The course used in the study was an undergraduate introductory leadership course with the core objective to educate students about the breadth of leadership theory. The face-to-face course was moderate sized (106 students) and the online delivery was smaller with only 36 students enrolled. The Institutional Review Board (IRB) approved this study prior to any data collection and the research protocol was approved (2011-U-1225).

The instructor created the course curriculum, assignments and activities with the guidance Beyer's (1987) approach to teaching thinking framework. For the introduction stage, the instructor created and delivered (both face-to-face and online) a 50-minute lecture covering the basic definitions, dispositions and skills of critical thinking. The importance and relevance of critical thinking to leadership and higher education is outlined as part of this process. Guided practice is integrated through course discussions (discussion board in online course) and activities (web-based work in online course). Further,

independent application was accomplished through their written papers over the course of the semester. Because the intent of the course is to provide the students with a survey of research theory, the instructor chose to focus on the stages emphasizing a singular application of critical thinking instruction (although, it would be hoped that the students personally experienced transfer and elaboration, as a result of the course). The course syllabus is available for a more detailed examination of the elements represented in each stage.

The population of the study included all students enrolled in the course over a two-semester period. The face-to-face data collection used a convenience sample of those students attending on the final day of the course (n=89), while all students in the online delivery course were invited to participate (n=36). Students were not required to complete the assessments and all participation was voluntary. The population of the course was a mix of students ranging in classification from freshmen (1) to senior (4), with 8 colleges represented and 27 different majors. In general, the course demographic aligns with the institution, with a majority of the students being Caucasian/white females.

To collect the necessary data, researchers used three existing questionnaires. To measure critical thinking style, the UFCTI (Lamm and Irani, 2011) was employed. This instrument measures students' self-perceived critical thinking style and is an adaptation extending work previously completed on critical thinking disposition (UF/EMI, Friedel et al., 2008; Lamm et al., 2011). The UFCTI focuses on an individual's range of critical thinking style anchored between Engagement style and Seeking Information style. The instrument, which is 20 items long, includes a Likert-type scale of Strongly Disagree (1) to Strongly Agree (5). Of the 20 questions, 13 individual items measure Seeking Information and seven items measure Engagement. While there are two individual scales, scores are derived as a total score and range from 26-130. The Engagement scale is shorter in length, and because of this, scores are weighted during scoring by 1.866 (Lamm and Irani, 2011). To interpret scores, respondents with a total score 73 or above may be identified as "Seeker" and 72 or below are considered to be "Engagers" (Lamm and Irani, 2011). Established reliability for the UFCTI is as follows: Seeking Information $\alpha=0.80$, Engagement $\alpha=0.80$ and the total UFCTI $\alpha=0.87$ (Lamm and Irani, 2011). Post-hoc analysis of reliability is provided later in the manuscript.

The CTI was administered using a post-test followed by a retrospective pre-test (postthen) design (Rockwell and Kohn, 1989). This design allows researchers to administer a pre-test following the intervention to correct for any, "limited knowledge in responding accurately to the questions being asked on the pretest" (p. 1). This "post-then-pre" design allows respondents to accurately gauge their learning by assessing post-test scores first followed by pre-test responses.

The course evaluation component was designed using the Foundation for Critical Thinking's Course

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Evaluation questionnaire. The intent of the evaluative form is to, "provide evidence of whether, and to what extent, students perceive faculty as fostering critical thinking instruction (course by course)" (The Critical Thinking Community, 2011, 5, item 1). Using a Likert-type scale ranging from Low Score (1) to High Score (5) students are asked to individually score 20 questions regarding course instruction. Examples of questions include: "To what extent does your instructor teach so as to enable you to think more accurately," "To what extent does your instructor teach so as to encourage critical thinking in the learning process," and "To what extent does your instructor teach so as to help you learn how to understand the key organizing concepts in the subject?" The range of scores is 20 to 100 with a mid-range break of 60 separating low and high scores. The Foundation for Critical Thinking does not provide any established psychometrics for this instrument. The research team evaluated the items for construct and face validity. Reliability was established post-hoc and is provided later.

While the face-to-face course utilized face-to-face data collection procedures, the online course utilized electronic data collection after the completion of the course. Using the Tailored Design Method (Dillman, 2009) students enrolled in the online course was invited to participate in the study using a 5-point contact strategy. This included a pre-notice, notice, reminder, follow-up and study closure. The instruments were adapted for web-based administration using Qualtrics. Data collection took place over six weeks following the course.

Due to the descriptive nature of the study, the researcher reported mean scores and standard deviations for each of the outlined objectives. The researcher used SPSS© to organize and analyze the data.

Lastly, the study participants were asked to complete a short demographic instrument to elicit the following information: age, gender, race/ethnicity, major and whether or not they had any previous experience or coursework emphasizing critical thinking.

Findings

The following findings represent data collected and analyzed with the purpose of completing each objective of the study. For the face-to-face data collection there were 106 individuals in the representative convenience sample on the day the questionnaires were administered. Of those, there were 89 respondents for a response rate of 84%; however, the total useable number of questionnaires completed was 77. The online administration yielded a smaller response with only eight respondents. In order to address the smaller response rate for the online administration, non-response was controlled for using a comparison of early and late respondents (Lindner, Murphy and Briers, 2001). Post hoc reliability analysis for the CTI confirmed appropriate reliability coefficients for the scales with the following results: CTI pre-test $\alpha=0.90$, CTI post-test $\alpha=0.90$ and the Course Evaluation $\alpha=0.95$.

The demographics are provided as a framework for understanding the nature of those individuals who responded. Of the 77 useable responses received, 31% ($n=24$) were male and 69% ($n=53$) were female. Further, ages ranged from 18-31 with the average being 21, $SD=1.7$.

The racial/ethnic make-up of students was largely Caucasian ($n=54$, 70%) with the next largest group being Hispanic ($n=15$, 20%). The remainder of the student racial/ethnic background accounted for 10% ($n=6$). There were a total of 28 different majors identified with the majority being Agricultural Education and Communication ($n=17$, 22%) followed by Accounting ($n=13$, 17%).

The intent of the first and second objectives was to determine the critical thinking style of students as identified in the UFCTI. To accomplish this objective students were given a post-test of their perceived critical thinking skill followed by a retrospective pre-test (post-then). Scores for the respondents were broken down into three scores: a pre-test CTI score, a post-test CTI score and a change in CTI scores. The total pre-test scores for respondents ranged from 41-99 points with a mean score of 78.68 (F2F) and 82.31 (online) with standard deviations of 9.95 ($n=69$) and 8.96 ($n=8$). Post-test scores ranged from 40-99 points with a mean score of 82.31 (F2F) and 89 (Online) with standard deviations of 8.96 and 3.34 respectively.

The pre-test mean scores indicate that respondents self-perceived their critical thinking skill as "seeker." Post-test scores indicate a strengthening of the seeker skill set. The change in scores showed that on average (mean) respondents moved 3.82 (F2F) and 10.62 (online) points with standard deviations of 6.60 (F2F) and 6.52 (online). Table 1 represents these figures.

Testing Pair	M		SD		Std. Error Mean	
	F2F	Online	F2F	Online	F2F	Online
Pre-Test	78.68	78.38	9.95	5.88	1.21	2.08
Post-Test	82.31	89.00	8.96	3.34	1.10	1.18
Change in CTI	3.82	10.62	6.60	6.52	.80	2.31

The third objective was to determine students' perceptions about course instruction as it relates to emphasizing critical thinking. Findings showed a range of 38 points in relation to perceptions of critical thinking skill with a minimum of 47 and a maximum of 85. Respondents indicated a mean score of 83.81 (F2F) and 84.25 (online) with standard deviations of 11.72 and 13.71 respectively, which shows high-level perceptions of critical thinking instruction integration.

Recommendations/Implications

Because of the nature of the limitations associated with this study, mainly the small rate of response in regards to the online sample, it is suggested that the recommendations provided below, be applied only to those in this study.

Objectives 1 and 2

This objective was used to determine the critical thinking style of students as identified in the UFCTI. The pre-test portion of objective one showed the most common participant critical thinking style to be “seeker” for both the face-to-face and online courses ($M=78.68/78.38$). The post-test portion of objective also showed gains in “seeker” behaviors with both the face-to-face and online courses showing positive change for stronger “seeker” behaviors ($M=82.31/89.00$). The computed differences were $M=3.82$ for the face-to-face instruction while the online instruction was $M=10.62$.

This change between the pre and post-test scores resulted in practical differences between the two sets of scores. Researchers believe this to be encouraging in relation to student perception of instructor level of critical thinking instruction. There are many implications that go along with these results. “Seekers” are different from “engagers” in that they seek opportunities to use their reasoning skills, while engaging behaviors require anticipating situations and confidence in those skills. “Seekers” can encourage instructors to increase their levels of critical thinking in their classroom instruction.

The researchers reflected on why the online course would have experienced greater gains than the face-to-face. One potential reason may be that in an online course the learners are expected many times (and particularly in this study’s course) to be more self-directed utilizing external research tools on their own. The face-to-face students are provided consistent access to the instructor and TA’s during instruction time and there is not the same emphasis on searching out information on their own, as in the online course where physical distance plays a key role in proximity and accessibility to instructor resources.

Further, the challenge becomes determining which of the styles is at an advantage for different types of activities. Students who are “seekers” may have a different level of awareness, but if we, as instructors, cannot encourage their confidence in their reasoning abilities, nor the ability to anticipate these situations, then what is the transferability of the critical thinking instruction?

Objective 3

This objective was to determine students’ perceptions about course instruction as it relates to emphasizing critical thinking. In relation to course instruction, student perceptions were very high, with a means of 83.81 (F2F) and 84.25 (online) out of 85 possible points. This number is very encouraging for the instruction of the course in the study. Students’ showed that they believe there is a high integration of critical thinking in the course included in the study. An implication of this result is that the instructor is high in critical thinking ability, which may translate to high integration in the class. Another implication is that the “seeker” style critical thinker may extract more critical thinking implications than “engager” style critical thinkers. The issue remains, are there untapped opportunities to

encourage students to strengthen their “engaging” style of critical thinking.

Conclusions

Overall, this study showed what researchers anticipated as a result of explicit critical thinking instruction in an undergraduate course. Specifically, the instructor of the course used, showed high integration of critical thinking skills and this was displayed in participant pre and post-test scores for both groups. Critical thinking is an important component that many employers are searching for in their potential employees, so critical thinking integration in the classroom is a great start to nurturing the critical thinking skills of students (McMillan, 1987).

It is shown that explicit instruction, including Beyer’s introduction stage, sets the framework for the students learning of critical thinking. This contrasts some approaches to critical thinking instruction, which fail to introduce and simply embed the instruction. Using the framework provided the instructor with a specific strategy to build capacity for critical thinking.

Also, the “seeker” style critical thinker was shown to be the majority in this study. Again, the potential reasons for such a great gain in seeking behaviors on behalf of the online course could be due to the greater opportunities to use seeking information (active learning) behavior within the course (Machemer and Crawford, 2007). Further research needs to be done to determine if instructors should be catering to a specific style of critical thinking when teaching certain courses. Researchers strongly encourage further research to be performed to determine if other instructors show high integration of critical thinking components in their classes and to determine if a certain critical thinking style is the majority in certain college majors. This could be clearly an indication that students do experience higher levels of self-efficacy gains when their thinking has been challenged, as is many times with critical thinking instruction (Terenzini et al., 1995). Explicit instruction in the area of critical thinking exposes students to the nuances of the behavior, which promotes the awareness of critical thinking expectations during the course. The more generalized these results can become, the better. Learning what types of students there are and how they perceive critical thinking integration in the classroom will lead to more effective teaching methods. These effective teaching methods may increase the critical thinking ability of graduates, which is what employers are looking for in college graduates.

Recommendations

A number of research and practice recommendations can be drawn from this study. These are outlined below and include:

Research

- Examine through an experimental design the impact of Beyer’s framework for teaching thinking

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- Expand the number of respondents in the online format
- Identify any differences in demographics related to gender and age
- Describe the role of the instructor's readiness to teach critical thinking on student critical thinking development
- Introduce difference teaching tools and strategies to examine their impact of student critical thinking development

Practice

- Instructors should use specific frameworks, like Beyer's, to design curriculum to maximize student critical thinking development
- Emphasize more seeking information behaviors in the face-to-face course, in order to encourage students to work independently
- Instructors should continue to develop their understanding of critical thinking to ensure that the introduction stage is relevant

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