

A Project titled

***The Impact of Pre-service Teachers' Dispositional Mindfulness on
Their Critical Thinking Dispositions***

Submitted by

CHEN Ming

submitted to The Education University of Hong Kong

for the degree of *Bachelor of Education (Honours) (Primary)-Mathematics*

in *April 2019*

Declaration

I, *CHEN Ming* , declare that this research report represents my own work under the supervision of Mr. LAM, Hiu Ming John, and that it has not been submitted previously for examination to any tertiary institution.

Signed

CHEN Ming

11 April 2019

Table of Contents

Abstract	4
Introduction	5
Method	14
<i>Instruments</i>	<i>14</i>
<i>Participants</i>	<i>19</i>
<i>Procedure</i>	<i>20</i>
Analysis Plan	21
Results	21
Discussion	24
Reference	30
Appendix A Information Sheet (English version)	43
Appendix B Information Sheet (Chinese version).....	45
Appendix C Consent form (English version)	46
Appendix D Consent form (Chinese version)	46
Appendix E Questionnaire	47

List of Tables

<i>Table 1: The Adapted version of the scale of University of Florida Engagement, Cognitive Maturity, Innovativeness (UF-EMI)</i>	16
<i>Table 2: 8-item Freiburg Mindfulness Inventory (FMI-8).....</i>	18
<i>Table 3: Reliability Table for Factors</i>	20
<i>Table 4: Table of Mean and Standard Deviation of Measures</i>	21
<i>Table 5: Correlation Table of the Survey Variables.....</i>	22
<i>Table 6: Summary of Hierarchical Regression Analysis for Variables Predicting Engagement, Cognitive Maturity and Innovativeness.....</i>	22

Abstract

The present study examined the impact of pre-service teachers' dispositional mindfulness on their levels of critical thinking dispositions. A total of 72 Hong Kong pre-service teachers participated in the research by responding to questions concerning their levels of dispositional mindfulness and critical thinking dispositions. Results of hierarchical regression analysis indicated mindful attention and awareness was specifically associated with problem-solving and decision making in critical thinking dispositions; secondly, mindful acceptance may predict less cognitive bias and greater cognitive openness, which are emphasized in critical thinking dispositions; lastly, dispositional mindfulness displayed insignificant relationship with intellectual curiosity, a third element in critical thinking dispositions. No significant gender difference was observed neither in pre-service teachers' level of dispositional mindfulness nor that of critical thinking dispositions. Findings enriched the understanding of the roles of dispositional mindfulness in predicting pre-service teachers' critical thinking dispositions.

Keywords: dispositional mindfulness, critical thinking dispositions, pre-service teachers, gender

The Impact of Pre-service Teachers' Dispositional Mindfulness on
Their Critical Thinking Dispositions

Introduction

Rapid social changes lead to different requirements for new generations. According to the World Economic Forum (2016), critical thinking (CT) has been identified as one of the core work-related skills. It is widely acknowledged that critical thinking is closely related to our daily life (Warnich & Inch, 2010). Studies revealed that critical thinking benefits students to work effectively and gain personal success (Carmichael & Farrell, 2012; Yang, 2012). Warren (2006) concluded that CT is something every college graduate should be equipped with. With the vast recognition of the significance of critical thinking, many governments proposed various policies in its promotion. For instance, the U.S. government called for raising up students' critical thinking skills as early as 1983 in one of the reports (National Commission on Excellence in Education, 1983), and Canadian federal government claimed that schools, colleges, and universities were supposed to foster critical thinking at all levels of schooling (Government of Canada, 2002). Hong Kong was not an exception; the Education Bureau reformed the school curriculum to integrate critical thinking skills as students' generic skills since 2000 (Curriculum Development Council, 2000). Education Bureau (2017) designed a four-stage development plan for primary and secondary students grounded on claiming critical thinking as "drawing out meaning from available data or statements and examining and questioning their accuracy and credibility in order" (p. 172). Sample definitions might be found in other studies. For instance, Facione (1990) indicated that:

The ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in

complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit. (p. 3)

Inch and Warnick (1994) identified critical thinking as a cognitive mechanism “to indicate problems, questions or situations; to integrate all available information; to reach hypotheses and results, and to affirm one’s idea” (p. 11). The complex and compound nature of critical thinking could be observed through these concepts. Despite no consensus on what CT is exactly has been achieved yet, Lai (2011) suggested scholars from the approaches of philosophy, cognitive psychology and education elaborated interpretations with different focuses. The philosophical stance identified CT as a reasonable and logical mindset, claiming that such thinking is embedded in certain criteria of adequacy and accuracy (Bailin, 2002), thereby individuals adopt CT to determine carefully and deliberately whether specific arguments or claim is true or sound (Epstein, 2000), and make meaningful and precise judgments (Diestler, 2001). In such a process as “what to believe and to do” referred by Ennis (1985), CT is regarded to be a beneficial norm to help individuals address the world with a fair mind (Dam & Volman, 2004). On the other hand, scholars from cognitive psychology approached conceptualize CT as cognitive and mental strategies to achieve purposeful outcomes (Halpern, 1998). The mental processes might involve the skills of multi-perspective thinking, openness to various evidence and opinions and justified reasoning (Willingham, 2007), hence, people are likely to achieve the goal of problem solving, reaching professional informed judgments and learn new concepts based on existing knowledge and phenomena (Sternberg, 1986; Halpern, 2003).

CT seems to be more applicable in classroom practice in terms of educational approach, which could be evident in constructivism, progressivism and Bloom’s taxonomy. In particular, Leach (2011) purposed that leaning how to think critically could be realized in a

constructivism classroom. Through the knowledge construction process depending on students' previous and current input (Wadsworth, 1971), students gain a series of experience related to critical thinking such as discussion and interactions with the outside world, along with constant inherent reflections and introspections (Leach, 2011). Similarly, learners' interactions with peers and teachers are exactly the core parts of progressivism (Slavin, 2009). Sadker and Sadker (2003) argued that progressivism classrooms promote students' ability of cooperation and acceptance of different opinions by interpersonal communication, which would ultimately result in an enhancement of critical thinking, in addition, Dewey (1933) also stressed the importance to think reflectively for students to adopt the subject knowledge into his own mind based on personal considerations. Lastly, Kennedy, Fisher, and Ennis (1991) stated that the three-upper layers in the original version of Bloom's taxonomy, namely analysis, synthesis and evaluation might represent the critical thinking. In Bloom's work (1956), he stated in the analysis level, learners have to decompose the materials into meaningful segments, so that they find the interconnections and recognize the underlying principles of the organization, arrangement, and structure; in terms of synthesise, students have to combine the elements in a more structured and clearer way and form them as a whole; finally evaluation was identified as adopting specific criteria to determine the appraisalment of certain values, arguments, solutions or works.

Albeit the differences among various definitions, Pascarella and Terenzini (2005) purposed that there are two dimensions of CT: critical thinking skills (CTS) and critical thinking dispositions (CTD). Firstly, CTS consists of a series of preconditions of cognitive efficiencies, such as arguments investigation, reasoning, evaluation, examining hypothesis, drawing conclusions, problem solving and so on (Lai, 2011). Some widely-used instruments provide hints for the operational definition of CTS. For instance, California critical thinking skills test (CCTST), Watson-Glaser Critical Thinking Appraisal (WGCTA), and Cornell Test of

Critical Thinking. CCTST, published by Facione (1990), focuses on the part of important cognitive skills identified by a Delphi research by American Philosophical Association, such as abilities to interpret (comprehend and disclose the nature of experiences, evaluations and so on), analyze (determine the relationships among various representations), evaluate (assess the credibility of statements and arguments), infer (identify evidence to form hypothesis and draw conclusions) and explain (indicate one's reasoning reasonably). Watson-Glaser CTA (Watson & Glaser, 2002) operationally involves the investigation on skills of investigating inference, recognition of assumptions, deduction, interpretation, evaluation of arguments. Cornell Critical Thinking Tests (Ennis, Millman, & Tomko, 1985) comprises Level X and Level Z. Level X is for students of grade 5-12, while Level Z is for talented and advanced adults and students in high schools and colleges. The test sheds light on a couple of types of capabilities: induction, deduction, observation, credibility, assumptions, and meanings.

Critical thinking dispositions

Individuals who own such abilities might not necessarily be motivated to bring out critical thinking (Ekinci & Ekinci, 2017), for the account that they might not be fostered to evaluate the problems, not be interested in problem solving nor not be eager to find diverse solutions (Irani et al., 2007). Tishman, Jay, and Perkins (1993) argued that these people need adequate critical thinking dispositions to stimulate critical thinking behaviors. Scholar identified critical thinking dispositions as a stable inner motivation (Facione, 2000), and such incentive could be a passion (Zhang, 2003), an attitude or sense of responsibility (Norris & Ennis, 1989), or a habitual mindset (Facione, 1990) towards critical thinking. On the other hand, Tishman et al. (1993) mentioned that dispositions also include sensitivity, which means the awareness of appropriate behavior, consequently, people would act to meet the specific standards of critical thinking. Halpern (1998) combined both sides of opinions and defined critical thinking dispositions as the manner of being unconditionally open to various ideas

and task commitment. Representative measurement for CTD is California Critical Thinking Disposition Inventory (CCTDI) by Facione, Facione and Sanchez (1994), which includes the subscales of truth-seeking, open-mindedness, analyticity, systematicity, critical thinking self-confidence, inquisitiveness, and maturity of judgment. The Truth-seeking scale addresses participants' inclination to seek answers and also being unbiased to evidence even that might object their points of views; the Open-mindedness scale targets at individuals' sensitivity to avoid narrowmindedness and acceptance of divergent thoughts; the Analyticity scale tests intelligently utilizing evidence to locate solutions, and difficulties anticipation to seek interventions, this would aid individuals to display appropriate behaviors; the Systematicity scale investigates how organized and focused a person is, this mental habit prevents one from being easily distracted and at risk for negligence, hence he could perform to meet the criteria of CT; the Critical thinking self-confidence scale assesses one's trust in his appraisal, this not only encourage individuals to display critical thinking but also to lead others in problems resolution process; the Inquisitiveness scale targets at participants' intellectual curiosity about the knowledge, it was suggested that such a desire could motivate individuals to continue learning and pursuing higher education ; the Maturity scale measures one's attitude to be cognitively logical in approaching problems and making decisions, as well as his admission of various solution to the problems.

School teachers play an important role in cultivating CT of next generations. It was pointed out that teachers' CT is a precondition to boost students' CT (Elder & Paul, 1994), and Abrami et al. (2008) proved that if teachers receive training on critical thinking, a greater effect on students could be observed. It has been very clear that educators who can deal with teaching with an objective and fair mind are needed in the contemporary era, due to the account for the significance of CT mentioned above (Elder & Paul, 2005). Unfortunately, studies indicated that teachers display insufficiency in their understanding of CT and the

implementation of CT-related classroom instructions. For instance, Stapleton (2011) revealed that although most participated in-service teachers in Hong Kong demonstrated clear ideas regarding the meaning of CT, their conceptions were too narrow. To make things worse, teachers of science and math reported there is little space to integrate critical thinking into their subject teaching. In another study, only a few Hong Kong in-service music teachers' participants successfully implement the procedures to foster students' CT, despite that more than half of them showed high belief and understanding of CTS, as well as willingness to integrate CT in their class (Lee, 2016). Regarding the situations of CTD, Temel (2014) found that student teachers in Science and Mathematics department scored low in CTD measured by CCTDI scale; when inviting the pre-service teachers from the departments of Computer Education and Instructional Technology, Guidance and Psychological Counselling, Primary School Education and Special Education, no significant differences were found among different departments, and all the departments exhibited lowest scores in truth-seeking scale (Alper, 2010). There have been several trials in increasing pre-service teachers' CTD, for instance, Kong (2001) found that CTD of Singapore pre-service teachers could be raised when enrolled in purposefully-designed courses. Similarly, pre-service language teachers in Arsal (2015) report higher CTD when microteaching was affiliated with the pedagogical course. Given the evidence for insufficiency in pre-service teachers' CTD, other potential approaches to enhance CTD worth exploration.

Dispositional mindfulness

One possible solution to heighten pre-service teachers' CTD might be mindfulness-related meditations grounded on their underlying relationship. As an increasingly heated topic, mindfulness centers on the value of consciousness (Hayes, 2003), as it requests paying attention exactly to present-moment experience instead of acting on 'automatic-pilot' with openness, acceptance, and nonjudgment (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006;

Bishop et al., 2004). Similarly, Dimidjian and Linehan (2003) suggested mindfulness consists of two components: mindful behaviors and how the behaviors are conducted. In terms of mindful behavior, individuals are supposed to carefully observe the ongoing experience, be able to describe what is happening and finally participate in it, and they should be nonjudgmental, one-minded and nonreactive during the process. The independence between two components has been clarified, such that higher level of awareness of present moment does not necessarily facilitate enhanced acceptance, neither vice versa (Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008). Authors also revealed an analogous result of no significant relationship between subscales of awareness (Cardaciotto et al., 2008). On the one hand, the claim emphasized the significance of both elements in concepts; on the other hand, the roles of the two components deserve investigation probably separately given the evidence for their distinctions. There are increasing numbers of meditations aiming at raising mindfulness such as Mindfulness-Based Stress Reduction (MBSR) (e.g., Crane, Kuyken, Hastings, Rothwell, & Williams, 2010), and Mindfulness-Based Cognitive Therapy (MBCT) (e.g., Segal, Williams, & Teasdale, 2018). Based on the individual differences in mindfulness levels found in those accepting similar therapies, it might be suggested mindfulness could be a kind of dispositional trait (Brown, Ryan, & Creswell, 2007; Walach, Buchheld, Buittenmuller, Kleinknecht, & Schmidt, 2006). Several self-reported questionnaires assessing dispositional mindfulness provide opportunities to explore the nature of dispositional mindfulness, for instance, Five Facets of Mindfulness (FFMQ) developed by Baer et al. (2006) includes 5 factors: observing (sample item such as “When I’m walking, I deliberately notice the sensations of my body moving”), describing (sample item such as “Even when I’m feeling terribly upset, I can find a way to put into words”), acting with awareness (sample item such as “I find myself doing things without paying attention”), non-judging (sample item such as “I disapprove of myself when I have irrational ideas”) and nonreactivity (sample item such as

“When I have distressing thoughts or images, I just notice them and let them go”); and Mindfulness Attention and Awareness Scale (MAAS) developed by Brown and Ryan (2003) assesses how an individual is attentive to and aware of here and now in everyday life, sample items consist ‘I snack without being aware that I’m eating’ and ‘I could be experiencing some emotion and not be conscious of it until sometime later’.

Mindfulness plays an important role in educational settings mainly in two ways. Firstly, teachers equipped with mindfulness are prone to exhibit multiple competences. Specifically, teachers receiving mindfulness training not only showed a higher level of mindfulness and focused attention, but also greater working memory abilities and job-related self-compassion (Roeser et al., 2013), and reported to experience less stress and burnout (Sharp & Jennings, 2016). In another study, it was found that such mindfulness program would be especially beneficial for beginning teachers to reduce occupational stress to teach during the first year of occupation (Bernay, 2012). Secondly, it was believed that such mindfulness could be transferred from teachers to students. In a classroom environment that encourages mindfulness practice by teachers, students are more likely to learn to utilize mindfulness traits in their own thinking. As a result, learning with greater meaning and sustainability learning could be realized (Ritchhart & Perkins, 2000).

Critical thinking dispositions and dispositional mindfulness

Shapiro, Brown, and Astin (2008) theoretically pointed out that the awareness brought by mindfulness to view in multi-perspectives without biases would aid the development of critical thinking, especially in terms of examining assumptions, evaluating evidence and finally drawing conclusions. Brown et al. (2007) elaborated that mindful individuals would carefully collect evidence to inform behaviors, thereby to avoid biased conclusions. The study of Adair and Fredrickson (2015) seemed to support this inference, which revealed that

participants tended to demonstrate more openness to missions when they become more focused on the present situation, and such dispositional mindfulness would predict higher objectivity by decreasing the adoption of top-down judgment. Moreover, it has been found that MBSR, a common mindfulness training program, efficiently improved performances in moral reasoning and ethical decision-making (Shapiro, Jazaieri, & Goldin, 2012). For the sake that mindfulness in social interactions would prohibit self-serving biases and egocentrism, individuals' capacities to take others' well-being into account and ethical decision-making might be fostered. Given the evidence claiming higher mindfulness may facilitate high-order cognition, a potential linkage might be expected between dispositional mindfulness and CT in research. Notwithstanding, to the best of knowledge, there is merely one study directly examining the connection and found a weak relationship between dispositional mindfulness and CT performance (Noone, Bunting, & Hogan, 2016). The study invited 178 university undergraduate students majoring in psychology in Ireland as participants. In terms of measurements, The Five Facet Mindfulness Questionnaire Short Form (FFMQ-SF) consisting 24 items was adopted to assess dispositional mindfulness, and The Halpern Critical Thinking Assessment (HCTA) was used to measure CT performances. It is noteworthy that HCTA mainly probes critical thinking skills such as argument analysis skills.

The present study

In the primary interest of exploring an alternative direction to increase pre-service teachers' CTD, the current study focuses on the dimension of disposition and to examine the potential relationship between dispositional mindfulness and CTD. With the research question: what is the impact of dispositional mindfulness on Hong Kong pre-service teachers' critical thinking dispositions? And hypothesis: Dispositional mindfulness has significant effects on critical

thinking dispositions in Hong Kong pre-service teachers. The results had been expected to provide theoretical evidence for experimental implementations in future studies.

Gender might be one of the co-variables in demographic information. There has been mixed evidence about the gender's influence on both CTD and CTS. For one thing, Scott, Markert, and Dunn (1998) and Yeh (1997) indicated that no gender difference was found in university students' critical thinking dispositions; for another thing, Nilgun (2011) revealed that pre-service science female teachers show significantly higher scores in open-mindedness scale than their male peers. While Lee (2016) revealed that Hong Kong male in-service music teachers demonstrated implementation of CTS more skillfully compared with their counterparts, furthermore, Walsh and Hardy (1999) found that female education major students demonstrated higher competence in CTD than their male counterparts. Nonetheless, there was limited research exploring or reporting the correlations between gender and dispositional mindfulness in a non-clinical population, there was one discovering that no significant gender differences in adults' dispositional mindfulness in mainland China (Kong, Wang, & Zhao, 2014). Gender was designed as the controlled variable in the research.

Method

Instruments

Critical thinking dispositions

Despite the wide use of CCTDI, Facione, Facione, and Sanchez (as cited in Bondy, Koenigseder, Ishe, & Williams, 2001) reported a few items loaded on more than one factor in factor analysis procedure, specifically, means for factor loadings of Analyticity scale was .39. Moreover, Walsh and Hardy (1997) pointed out that stability was not achieved across different sample groups, and the analysis did not justify a discrete Inquisitiveness subscale.

Inspired by CCTDI, the scale of University of Florida Engagement, Cognitive Maturity, Innovativeness (UF-EMI) was developed by Irani et al. (2007) and it consists of three dimensions in the scale: Engagement (11 items), Cognitive Maturity (8 items) and Innovativeness (7 items). Engagement subscale measures reasoning abilities, self-confidence in reasoning, problem-solving and decisions makings; Cognitive maturity targets at the sensitivity towards individuals' tendencies and prejudice in decision making and openness to various answers and multiple viewpoints; Innovativeness, equivalent to inquisitiveness subscale in CCTDI, assesses being curious and motivated to learn new knowledge. The scale items are given scores varying from 1-strongly disagree to 5-strongly agree. The instrument has been used in many studies. For instance, Stedman and Andenoro (2007) probed the relationship between emotional intelligence and CTD in American undergraduate leadership students; Ekinci and Ekinci (2017) studied the relationship between Turkish teachers' CTD and perception of occupational professionalism; Bell and Loon (2015) investigated the influence of CTD on UK undergraduate students' engagement in business simulation. The reliability and validity of the instrument was not reported in original paper, yet it could be found in Kiliç and Sen (2014), which involved 342 Turkish students from Grade 9 and Grade 10, and the results of confirmatory factor analysis showed that RMSEA= .074, GFI= .84, AGFI= .81, NFI= .91, NNFI= .94 and CFI= .94. The scale adjusted in Bell and Loon (2015) demonstrated the outcome of KMO test of .853, and the item 'I keep on working on things until I get them right' was removed because the factor loading result was below .4, and the three-factor structure accounted for 43.24% of the variance. All the dimensions exhibit Cronbach Alpha greater than .7, and factor loading each item varies from .412 to .770 in the study. According to appropriate statistical results in Bell and Loon (2015), the adapted version of the scale shown below in Table 1 was utilized in this essay.

Table 1

The Adapted version of the scale of University of Florida Engagement, Cognitive Maturity, Innovativeness (UF-EMI)

Dimensions	Item Description
Engagement	1. I am a good problem solver
	2. I am confident that I can reach a reasonable conclusion
	3. I am able to relate to a wide variety of issues
	4. I am able to explain things clearly
	5. I am able to apply my knowledge to a wide variety of issues
	6. I present issues in a clear and precise manner
	7. I enjoy finding answers to challenging questions
	8. I am interested in many issues
	9. I look for opportunities to solve problems
	10. I ask focused questions when trying to clarify a solution
	11. It is important to be well informed
Cognitive Maturity	12. I listen carefully to the opinions of others even when they disagree with me
	13. I believe that most problems have more than one solution
	14. I ask many questions when making a decision
	15. I consider how my own biases affect my opinions
	16. I try to understand the facts without letting my biases affect my decisions
	17. I try to find multiple solutions to problems
	18. I can get along with people who do not share my opinions
	19. I am likely to change my opinion when I am given new

	information that conflicts with my current opinion
Innovativeness	20. I enjoy learning about many topics
	21. I will go out of my way to find the right answers to a problem
	22. I search for the truth even when it makes me uncomfortable
	23. I ask lots of questions in a learning environment
	24. I enjoy learning even when I am not in University
	25. I enjoy solving problems

The item scores were averaged as dependent variables, with higher mean represents a higher level of critical thinking dispositions in the corresponding domains. Cronbach's $\alpha = .815$ for the factor of Engagement, Cronbach's $\alpha = .610$ for the factor of Cognitive Maturity, and Cronbach's $\alpha = .723$ for the factor of Innovativeness. It is noteworthy that despite Cronbach's $\alpha = .610$ is lower than normality that α should be greater than .70 (Cortina, 1993), yet the figure is still within the range of moderate (.61- .65) according to a review of Taber (2016).

Dispositional Mindfulness

Buchheld, Grossman and Walach (2001) initially developed a 30-item Freiburg Mindfulness Inventory (FMI) in a four-factor model conceptualized on Buddhist psychology, five years later, Walach, Buchheld, Buittenmüller, Kleinknecht and Schmidt (2006) suggested that one factor might be better and published a short-form of FMI (FMI-14). The 4-point Likert scale ranges from 1 (rarely) to 4 (almost always), and short version was reported to correlate almost perfectly with the original version, in terms of usefulness and it was believed that short-form also covers all aspects of dispositional mindfulness (Walach et al., 2006). FMI-14 was used

by Hue and Lau (2015) to measure HK pre-service teachers' dispositional mindfulness. In the study of Kohls, Sauer, and Walach (2009), structural equation modeling (SEM) was adopted to test the factorial structure of FMI. Confirmatory analysis was done on one factor model of Mindfulness (14 items) and two-factor model of Mindfulness consisting of acceptance (8 items, focusing on mindful acceptance to experience with openness) and presence (6 items, targeting at awareness and attention to the present moment). Result were CMIN/df=3.441 and 3.171; CFI was .977 and .980; TLI= .969 and .972; RMSEA= .107 and .0101 for two models respectively, the author claimed these data was not adequately satisfactory and reduced the form to a two-factor model consisting 8 items only with the factors of acceptance and presence, CMIN/df=1.88, CFI= .996, TLI= .993 and RMSEA= .064, which turned out to be better. Considering the convincing statistics results, the 8-item scale was used in this study and the item description could be found below in Table 2.

Table 2

8-item Freiburg Mindfulness Inventory (FMI-8)

Dimensions	Item Description
	1. I am able to appreciate myself.
	2. In difficult situations, I can pause without immediate reacting.
Acceptance	3. I am friendly to myself when things go wrong.
	4. I experience moments of inner peace and ease, even when things get hectic and stressful.
	5. I am open to the experience of the present moment.
Presence	6. When I notice an absence of mind, I gently return to the experience of the here and now.
	7. I pay attention to what's behind my actions.

8. I feel connected to my experience in the here-and-now.

The item scores were averaged as independent variables, with higher mean represents higher level of dispositional mindfulness in the corresponding domains. Cronbach's $\alpha = .608$ for the factor of Acceptance, Cronbach's $\alpha = .706$ for the factor of Presence. It is noteworthy that despite Cronbach's $\alpha = .608$ is lower than a normality that α should be greater than .70 (Cortina, 1993), the figure is still within the range of Satisfactory (.58- .97) according to a review of Taber (2016).

Participants

According to the result of linear multiple regression test generated by G-power, with effect size $f^2 = 0.15$, $\alpha = 0.05$, power ($1 - \beta$ error prob) = 0.8, 2 tested predictors (acceptance and presence) and 1 controlled predictor (gender), the appropriate number of participants was 68. 10 more participants were invited in case of any data exclusion. In total, 78 Bachelor of Education (BEd) students from Education University of Hong Kong (EdUHK) were recruited via random sampling and convenient sampling. The Education University of Hong Kong (EdUHK) claimed to play a distinctive role in leading education with a tradition in teacher education (Cheung, n.d.) by offering a wide range of 5-year full-time bachelor-level teacher training programs. EdUHK employment survey indicated that 92.7% full-time pre-service graduate were employed, and 94.7% employed engaged in education, among whom, 98.2% held teaching posts (Student Affair Office, 2018), hence students from education programs could be assumed as the prospective teachers in Hong Kong society. In total, 6 participants were excluded. 3 participants (ID=55, 3 and 74) were identified as outliers on scatterplots,

and the rest (ID=68, 4 and 50) were regarded as influential points considering standard deviation on 5 subscales: Cri-Enga, Cri-CogMa, Cri-Inno, Mind-Acce and Mind-Pre, Leverage values, p-value of Mahalanobis distance and p-value of Cook's distance. Table 3 presents the results of reliability tests on each subscale after excluding participants one by one. The finalized Cronbach's α exhibited in the last line has been reported above.

Table 3

Reliability Table for Factors

	Cri-Enga	Cri-CogMa	Cri-Inno	Mind-Acce	Mind-Pre
Original	.818	.567	.755	.643	.746
After excluding ID=					
55	.819	.571	.723	.656	.760
3	.820	.570	.724	.660	.707
74	.807	.572	.726	.651	.684
68	.810	.578	.735	.610	.688
4	.812	.600	.728	.629	.702
50	.815	.610	.723	.608	.706

Ultimately, 72 BEd students between 18 and 27 years of age ($M = 21.65$; $SD = 1.74$) were included in the current study, comprising more females ($n = 54$; 75%) than males ($n = 18$; 25%). Albeit a larger proportion of females, the composition was comparable to data of Census and Statistics Department (2018) reporting 50593 females (73%) and 18675 male (27%) teachers working in either kindergartens, primary schools or secondary day schools in Hong Kong.

Procedure

Participants were recruited through advertisement at university intranet forums and social media (e.g., Wechat and Whatsapp), in which information sheet (see Appendix A for English version and Appendix B for Chinese version) was presented, and consent (see Appendix C for English version and Appendix D for Chinese version) was sought before participation.

The website link of the online survey had been attached in the advertisement, and participants could directly join in the survey by clicking on the link. Participants will be asked to finish a questionnaire (see Appendix E), which averagely took 5 minutes to complete.

Analysis Plan

Hierarchical regression was used to test the hypothesis of whether dispositional mindfulness could predict CTD. Lewis (2007) proposed that hierarchical regression is advantageous in investigating the effects of predictors upon previously input predictors, and the change of R^2 in each step of analysis illustrates the increment in variance. Moreover, it has been pointed out that hierarchical regression is especially useful in the analysis where predictors are correlated with each other (Pedhazur, 1997). Considering the presence of controlled variable and a potential link between predictors, hierarchical regression was utilized in the research design. In three models with outcomes of means of Cri-Enga, Cri-CogMa and Cri-Inno respectively, gender was computed in the first step as the controlled predictor, followed by the entry of means of Mind-Acce and Mind-Pre as tested predictors during the second step, the validity increment was expected to account for predicting the effect.

Results

Table 4

Table of Mean and Standard Deviation of Measures

	Mean	Std. Deviation
Cri-Enga	3.75	.42
Cri-CogMa	3.86	.37
Cri-Inno	3.80	.46
Mind-Acce	2.86	.43
Mind-Pre	3.01	.41

In Table 4, the means and standard deviation for the CTD and dispositional mindfulness are reported. Pre-service teachers' CTD and dispositional mindfulness were relatively high in terms of the scores taken from factors. Notwithstanding, the mean scores of CTD factors were slightly lower compared to that of Turkish in-service teachers (Cri-Enga: $M= 4.04$, $SD=.55$; Cri-CogMa: $M= 4.06$, $SD= .57$; Cri-Inno: $M= 4.03$, $SD= .58$; Ekinci & Ekinci, 2017). A correlation matrix consisting of all survey variables is displayed in Table 5. Gender was found to correlate weakly with other variables, while significant correlations could be observed between each pair of independent variables and dependent variables. Moreover, the correlation between 2 independent variables (Mind-Acce and Mind-Pre) was also strong, which contrasted with the findings of Cardaciotto et al. (2008).

Table 5

Correlation Table of the Survey Variables

	1	2	3	4	5
1. Gender					
2. Cri-Enga	.145				
3. Cri-CogMa	.096	.481**			
4. Cri-Inno	.097	.693**	.502**		
5. Mind-Acce	.033	.327**	.405**	.321**	
6. Mind-Pre	.069	.381**	.377**	.334**	.604**

Note. ** Correlation is significant at the 0.01 level (2-tailed)

Table 6

Summary of Hierarchical Regression Analysis for Variables Predicting Engagement, Cognitive Maturity and Innovativeness (N = 72)

IV	Model 1 Outcome: Cri-Enga	Model 2 Outcome: Cri-CogMa	Model 3 Outcome: Cri-Inno
Controlled variable: Gender	$b= .14$ $t=1.23$ $p= .23$ VIF=1.00 $R^2= .02$ $F=1.50$	$b= .08$ $t= .81$ $p= .42$ VIF=1.00 $R^2= .01$ $F= .65$	$b= .10$ $t= .82$ $p= .42$ VIF=1.00 $R^2= .01$ $F= .67$

	$p = .23$	$p = .42$	$p = .42$
Controlled variable:	$b = .09$ $t = 1.10$ $p = .41$	$b = .06$ $t = .67$ $p = .51$	$b = .08$ $t = .67$ $p = .50$
Gender	VIF=1.01	VIF=1.01	VIF=1.01
Predictor: Mind-Acceptance	$b = .15$ $t = 1.11$ $p = .27$	$b = .24$ $t = 2.05$ $p = .044^*$	$b = .20$ $t = 1.34$ $p = .19$
	VIF=1.58	VIF=1.58	VIF=1.58
Mind-Pre	$b = .28$ $t = 2.02$ $p = .047^*$	$b = .18$ $t = 1.48$ $p = .143$	$b = .24$ $t = 1.52$ $p = .13$
	VIF=1.58	VIF=1.58	VIF=1.58
	$R^2 = .17$	$R^2 = .20$	$R^2 = .14$
	$F = 4.80$	$F = 5.55$	$F = 3.68$
	$p = .004^{**}$	$p = .002^{**}$	$p = .02^*$
	$\Delta R^2 = .15$	$\Delta R^2 = .19$	$\Delta R^2 = .13$
	$\Delta F = 6.33$	$\Delta F = 7.94$	$\Delta F = 5.14$
	$p = .003^{**}$	$p < .001^{***}$	$p < .01^{**}$

Notes. $*p < .05$, $**p < .01$, $***p < .001$

Table 6 exhibits the result of hierarchical regression analysis. All VIF were less than 5, hence, there was no multicollinearity problem (Hair, Ringle, & Sarstedt, 2011). In model 1 with the outcome of factor of Engagement, $F(3,68) = 4.80$, $p = .004$, $R^2 = .17$ indicated that 17% variance of Cri-Enga could be predicted by 3 predictors (Gender, Mind-Acceptance and Mind-Pre), while $\Delta F(2,68) = 6.33$, $p = .003$, $\Delta R^2 = .15$ indicated that 15% variance of Cri-Enga could be predicted by 2 predictors (Mind-Acceptance and Mind-Pre) upon gender. Only the factor of Presence demonstrated significant effect on Engagement ($b = .28$, $t(68) = 2.02$, $p = .047$). When partialling out the effects of gender and Acceptance on Engagement, 1 unit of increment of Presence would predict .28 unit of increment of Engagement.

The regression equation: $\text{Cri-Enga}_i = 2.44 + .11\text{gender}_i + .15\text{Mind-Acceptance}_i + .28\text{Mind-Pre}_i + \epsilon_i$

In model 2 with the outcome of factor of Cognitive Maturity, $F(3,68) = 5.55$, $p = .002$. $R^2 = .20$ indicated that 20% variance of Cri-CogMa could be predicted by 3 predictors (Gender, Mind-Acceptance and Mind-Pre), while $\Delta F(2,68) = 7.94$, $p = .001$, $\Delta R^2 = .19$ indicated that 19% variance of Cri-CogMa could be predicted by 2 predictors (Mind-Acceptance and Mind-Pre) upon

gender. Only the factor of Acceptance demonstrated significant effect on Engagement ($b = .24, t(68) = 2.05, p = .044$). When partialling out the effects of gender and Presence on Engagement, 1 unit of increment of Acceptance would predict .28 unit of increment of Cognitive Maturity.

The regression equation: $Cri-CogMa_i = 2.61 + .06gender_i + .24Mind-Accept_i + .18Mind-Pre_i + \epsilon_i$

In model 3 with the outcome of factor of Innovativeness, $F(3,68) = 3.68, p = .016, R^2 = .14$ indicates that 14% variance of Cri-Inno could be predicted by 3 predictors (Gender, Mind-Accept and Mind-Pre), while $\Delta F(2,68) = 5.14, p = .008, \Delta R^2 = .13$ indicates that 13% variance of Cri-Inno could be predicted by 2 predictors (Mind-Accept and Mind-Pre) upon gender. Neither Mind-Accept or Mind-Pre displayed significant effect on Cri-Inno.

The regression equation: $Cri-CogMa_i = 2.61 + .06gender_i + .24Mind-Accept_i + .18Mind-Pre_i + \epsilon_i$

In conclusion, the results partially supported the hypothesis that dispositional mindfulness displays significant effect on critical thinking dispositions by finding the significant effect of Presence on Engagement and that of Acceptance on Cognitive Maturity.

Discussion

The primary goal of the current study was to examine the impact of dispositional mindfulness on CTD. Dispositional mindfulness was hypothesized to facilitate CTD, and this hypothesis was based on previous studies claiming potential linkage between mindfulness and CT performances. The direct effect was examined by hierarchical regression in three models, each of which revealed interesting findings.

Model 1: Significant effect of the factor of Presence on the factor of Engagement

The factor of Engagement mainly assessed the self-rated performance in problem-solving and decision making, which has been shown to associate with mindful attention to the present moment examined by the factor of Presence. The finding supports Ruedy and Schweitzer (2010), which identified a positive relationship between mindful attention measured by MAAS and ethical decision making, and the current study is in align with Ostafin and Kassman (2012) where a positive link between mindful awareness and insight problem-solving was established. The first component in the factor of Presence is attention, which could be further specified to sustained attention and switching attention. Sustained attention refers to the ability to concentrate on a single object for long time (Parasuraman, 1998), such concentration facilitates effective problem-solving and decision making by aiding searching for significant elements and meaningful information (Murray & Byrne, 2005). Consistent with this account, sustained attention engenders more accurate judgments on the morality, based on more precise interpretations of the current situation in the procedure of ethical decision making (O'Fallon & Butterfield, 2005). Switching attention represents the capacity to swap focus among a few objects (Posner, 1980), and it plays significant role in solving insight problems. Insight problems are uncommon problems such that regular methods based on past experience may fail to generate a valid solution (Ohlsson, 1992). If individuals restrain their attention on specific pieces of information as usual, they are likely to get stuck in such customary approaches. Switching attention preserves the considerations of other information and possibilities in mind to produce new connections among all essential elements, and that might lead to alternative strategies (Murray & Byrne, 2005). Similarly, habitual responses triggered from prior experience may hinder the insight problem solving. When individuals live in the present moment, as stressed in the factor of Presence, they will be less affected by reactionary thoughts and less refer to the memories solving similar problems (Shapiro, Carlson, Astin, & Freedman, 2006). As a result, individuals are supposed

to take the current issue as a new one and restructure it from the very beginning, in particular, people are prone to experience an “Aha” moment to acquire insight in the restructuring process (Ostafin & Kassman, 2012).

Model 2: Significant effect of the factor of Acceptance on the factor of Cognitive Maturity

The result of Model 2 reveals a noticeable impact of mindful acceptance on both cognitive bias and openness to diverse opinions, two vital components in the factor of Cognitive Maturity. It has been reflected in the definitions that individuals would perceive the experience as itself without cognitive defense in the state of acceptance (Hayes, 1994), suggesting that he or she does not bear any preconceived opinions in mind and merely keep an openness to reality (Roemer & Orsillo, 2003). In the context of acceptance, one releases forearmed prejudice, judgments and belief in mind without intention to make any change. Hence, he or she is more likely to embrace all experience, thoughts, and ideas with a blank mind (Cardaciotto et al., 2008). In turn, this might account for the weak correlation between the factor of Acceptance and the factor of Engagement ($b = .15$, $t = 1.11$, $p = .27$). Problem-solving and decision making in the factor of Engagement are associated with high levels of cognitive efforts to actively identify core issues, find solutions or draw conclusions, however, individuals engaged in the stance of acceptance attempt to avoid making efforts by admitting ongoing experience (Noone et al., 2016), along with this account, mindful acceptance may play an adverse role in predicting the factor of Engagement. However, the finding is interesting to reveal a nonsignificant but positive relationship between variables, suggesting the potential existence of underlying factors that mediate the mechanism. Future studies may investigate the mechanism to enhance the understanding of current knowledge. Additionally, acceptance also involves the acknowledgement on internal activities, such as one's thoughts, moods, and sensations (Bishop et al., 2004). Chambers, Lo and Allen (2008) pointed out that such acceptance aids ones to admit intrapersonal stimuli equanimous and prevents the

occurrence of negative emotions. Generally, unpleasant moods such as anxiety or shame would provoke cognitive resistance and shut out multiple opinions (Baer, 2003), mindful acceptance stops such a process from the beginning. In other words, individuals are less likely to produce pessimistic emotions in the condition of permitting whatever enters intrapersonal experience, and with the absence of conscious fence as a result of suppressed negative feelings, they are more likely to welcome divergent ideas. Lastly, explanations could be found in the field of neuroscience. Amodio (2014) verified that activation in amygdala would foster implicit prejudice, and decreased activation in the amygdala was reported after participants receive mindfulness-based meditation, which demonstrated mediation effect in the mechanism of emotion regulations (Lutz et al., 2013; Tang, Hölzel, & Posner, 2015).

Model 3: No significant effect of the dispositional mindfulness on the factor of innovativeness

The result of Model 3 discloses an insignificant impact of mindfulness on intellectual curiosity, as the key word in components in the factor of Innovativeness. The finding supports the results of Niemiec et al. (2010) displaying no significant relationship between mindfulness and the factor of openness to experience, which includes the item “I have a lot of intellectual curiosity”. Notwithstanding, the correlation between intellectual curiosity and mindfulness could be found in few studies, one of the reasons might be different interpretations of the term. Irani et al. (2007) indicated curiosity as outward by stressing learning concerning outer environment and world, while intrapersonal curiosity is emphasized in the context of mindfulness (Litman, Robinson, & Demetre, 2017). Specifically, Toronto Mindfulness Scale developed by Lau et al. (2006) involves a subscale of curiosity, with a typical item such as “I was curious about each of the thoughts and feelings that I was having”.

The result of current study implied no gender difference on critical thinking dispositions, which was consistent with Yeh (1997) yet contrary with other studies (e.g., Nilgun, 2011; Walsh & Hardy, 1999; McBride, Xiang, & Wittenburg, 2002). Despite all the research included pre-service teachers as participants, none of them was carried out in Hong Kong or ethnical Chinese contexts. Considering the potential cultural influence that critical thinking is not encouraged in ethnical Chinese society with stress on Confucianism to follow the authority (Tsui, 2002; Mok & Yuen, 2016), the present study provides a clearer picture for the impact of genders on pre-service teachers' CTD under east-Asian background. Moreover, future research might consider the crossed effect of culture and gender on CTD to enhance the current knowledge. The findings also indicate no gender difference on dispositional mindfulness, which was in align with a few studies (e.g., Goodall, Trejnowska, & Darling, 2012; Howell, Digdon, Buro, & Sheptycki, 2008; Kong, Wang, & Zhao, 2014). None of these studies focused on pre-service teachers. Hence, the current study attempted to enrich the information by providing certain evidence in teacher training programs.

To the best of available information, the current study is the first research focusing on the relationship between dispositional mindfulness and critical thinking dispositions. The findings contributed to supplying several implications for enhancing pre-service teachers' CTD via taking advantages of various mindfulness-based training (e.g., Roeser, Skinner, Beers, & Jennings, 2012). Since CTD is indeed a broad concept that includes multiple high-order cognition, the results happened to provide evidence for discriminatory exercise on enhancing different critical thinking performances. Firstly, pre-service teachers' performance of problem-solving and decision-making could be improved by practicing mindful attention and awareness. It is believed greater present-focused attention and awareness aids seeking information and learning knowledge, which would ultimately heighten the quality of solutions to the problems and decisions made; secondly, the meditation on mindful

acceptance might reduce student educators' cognitive bias and strengthen their open-mindedness. Individuals are more likely to adopt divergent thoughts in a state of admitting internal and external ongoing experience; lastly, pre-service teachers of both genders might benefit from such intervention to the same extent.

There are several observable limitations in the present study. Research depends exclusively on self-reported instruments, which are susceptible to subject bias such as social desirability. In addition, the reliability of certain factors is acceptable yet low. Future work may replicate the research with more reliable instruments testing CTD and dispositional mindfulness, or investigate variables in other methods rather than self-rated measurements, e.g., observations. Moreover, the absence of intervention or meditation limited the study in finding out any causal relationship among variables, although the present study attempted to supply some theoretical evidence, the roles of dispositional mindfulness on critical thinking dispositions would be more advanced with an experimental approach. Ultimately, it would also be informative to investigate the link between dispositional mindfulness and intellectual curiosity, which may complement the current knowledge.

Reference

- Abrami, P. C., Bernard, R. M., Borohovski, E., Wade, A., Surkes, M. A., Tamim, R., & Zhang, D. (2008). Instructional interventions affecting critical thinking skills and dispositions: A stage 1 meta-analysis. *Review of Educational Research, 78*(4), 1102-1134.
- Adair, K. C., & Fredrickson, B. L. (2015). Be open: Mindfulness predicts reduced motivated perception. *Personality and Individual Differences, 83*, 198-201.
- Alper, A. (2010). Critical Thinking Disposition of Pre-Service Teachers. *Education and Science, 35*(158), 14-27.
- Amodio, D. M. (2014). The neuroscience of prejudice and stereotyping. *Nature Reviews Neuroscience, 15*, 670-682.
- Arsal, Z. (2015). The Effects of Microteaching on the Critical Thinking Dispositions of Pre-service Teachers. *Australian Journal of Teacher Education, 40*(3). 140-153.
doi:10.14221/ajte.2014v40n3.9
- Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical Psychology: Science and Practice, 10*(2), 125–143.
- Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment, 13*(1), 27-45.
- Bailin, S. (2002). Critical thinking and science education. *Science and Education, 11*(4), 361-375.
- Bell, R., & Loon, M. (2015). The impact of critical thinking disposition on learning using business simulations. *The International Journal of Management Education, 13*(2), 119-127.

- Bernay, R. S. (2012). *Mindfulness and the beginning teacher* (Doctoral dissertation, Auckland University of Technology).
- Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., et al. (2004). Mindfulness: a proposed operational definition. *Clinical Psychology: Science and Practice, 11*, 230–241.
- Bloom, B. S. (1956). *Taxonomy of Educational Objectives. Vol. 1: Cognitive Domain*. New York: McKay.
- Bondy, K. N., Koenigseder, L. A., Ishee, J. H., & Williams, B. G. (2001). Psychometric properties of the California critical thinking tests. *Journal of Nursing Measurement, 9*(3), 309-328.
- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84*(4), 822 – 848.
- Brown, K., Ryan, R. M., & Creswell, J. (2007). Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychological Inquiry, 18*, 211–237.
doi:10.1080/10478400701598298.
- Buchheld, N., Grossman, P., & Walach, H. (2001). Measuring mindfulness in insight meditation (Vipassana) and meditation-based psychotherapy: The development of the Freiburg Mindfulness Inventory (FMI). *Journal for Meditation and Meditation Research, 1*, 11-34.
- Cardaciotto, L., Herbert, J. D., Forman, E. M., Moitra, E., & Farrow, V. (2008). The assessment of present-moment awareness and acceptance: The Philadelphia Mindfulness Scale. *Assessment, 15*(2), 204-223.

- Carmichael, E., & Farrell, H. (2012). Evaluation of the effectiveness of online resources in developing student critical thinking: Review of literature and case study of a critical thinking online site. *Journal of University Teaching and Learning Practice*, 9(1), 1-17.
- Census and Statistics Department. (2018). *Women and Men in Hong Kong Key Statistics*. Retrieved from <https://www.statistics.gov.hk/pub/B11303032018AN18B0100.pdf>
- Chambers, R., Lo, B. C. Y., & Allen, N. B. (2008). The impact of intensive mindfulness training on attentional control, cognitive style, and affect. *Cognitive Therapy and Research*, 32(3), 303-322.
- Cheung, S. Y. L. (n.d.). *Welcome to EdUHK*. Retrieved from <https://www.eduhk.hk/main/about-us/offices-of-the-president/welcome/>
- Crane, R. S., Kuyken, W., Hastings, R. P., Rothwell, N., & Williams, J. M. G. (2010). Training teachers to deliver mindfulness-based interventions: Learning from the UK experience. *Mindfulness*, 1(2), 74-86.
- Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology*, 78(1), 98-104.
- Curriculum Development Council. (2000). *Learning to Learn: The Way Forward in Curriculum: Life-long Learning and Whole -person Development*. Retrieved from <https://www.edb.gov.hk/attachment/en/curriculum-development/cs-curriculum-doc-report/learn-learn-1/overview-e.pdf>
- Dam, G., & Volman, M. (2004). Critical thinking as a citizenship competence: Teaching strategies. *Learning and Instruction*, 14, 359-379.
- Dewey, J. (1933). *How We Think*. New York: D.C Health & Co Publishers.

- Diestler, S. (2001). *Becoming a critical thinker: A user friendly manual* (3rd ed.). New Jersey: Prentice Hall.
- Dimidjian, S., & Linehan, M. M. (2003). Mindfulness practice. In W. O'Donohue, J. E. Fisher, & S. C. Hayes (Eds.), *Empirically supported techniques of cognitive behavior therapy: A step-by-step guide for clinicians*. New York: John Wiley.
- Education Bureau. (2017). *Resource Package on "The Integrative Use of Generic Skills": in Junior Secondary Subjects in Personal, Social and Humanities Education Key Learning Area*. Retrieved from https://www.edb.gov.hk/attachment/en/curriculum-development/kla/pshe/reference-and-resources/Resource_Package_on_The_Integrative_Use_of_Generic_Skills.pdf
- Ekinci, C. E., & Ekinci, N. (2017). A Study on the Relationships between Teachers' Critical Thinking Dispositions and Their Perceptions of Occupational Professionalism. *Educational Process International Journal*, 6(2), 53-78.
- Elder, L., & Paul, R. (1994). Critical thinking: why we must transform our thinking. *Journal of Developmental Education*, 18(1), 34-35.
- Elder, L., & Paul, R. (2005). *A miniature guide for students and faculty to the foundations of analytic thinking: How to take thinking apart and what to look for when you do—The elements of thinking and the standards they must meet*. Dillon Beach, CA: Foundation for Critical Thinking.
- Ennis, R. H. (1985). A logical basis for measuring critical thinking skills. *Educational Leadership*. 43(2), 44-48.
- Ennis, R. H., Millman, J., & Tomko, T. N. (1985). *Cornell critical thinking tests level X & level Z: Manual*. Pacific Grove, CA: Midwest Publications.

- Epstein, R. L. (2000). *The pocket guide to critical thinking*. California, USA: Wadsworth Publishing Company.
- Facione, N. C., Facione, P. A., & Sanchez, C. A. (1994). Critical thinking disposition as a measure of competent clinical judgment: The development of the California Critical Thinking Disposition Inventory. *Journal of Nursing Education, 33*(8), 345-350.
- Facione, P. A. (1990). *The California Critical Thinking Skills Test--College Level. Technical Report# 1. Experimental Validation and Content Validity*. Millbrae, CA: California Academic Press.
- Facione, P. (1990). *Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction (The Delphi Report)*.
- Facione, P. A. (2000). The disposition toward critical thinking: Its character, measurement, and relationship to critical thinking skill. *Informal Logic, 20*(1), 61-84.
- Goodall, K., Trejnowska, A., & Darling, S. (2012). The relationship between dispositional mindfulness, attachment security and emotion regulation. *Personality and Individual Differences, 52*(5), 622–626.
- Government of Canada. (2002). *Knowledge matters: Skills and learning for Canadians*. Retrieved from <http://publications.gc.ca/collections/Collection/RH64-13-2002E.pdf>
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice, 19*(2), 139-152.
- Halpern, D. F. (1998). Teaching critical thinking for transfer across domains: Disposition, skills, structure training, and metacognitive monitoring. *American Psychologist, 53*(4), 449.

- Halpern, D. F. (2003). *Thought & knowledge: An introduction to critical thinking*. London: Lawrence Erlbaum Associates Publishers.
- Hayes, R. P. (2003). Classical Buddhist model of a healthy mind. In K. H. Docket, G. R. Dudley-Grant, & C. P. Bankart (Eds.), *Psychology and Buddhism: From Individual to Global Community* (pp. 161–170). New York, Boston, Dordrecht: Kluwer Academic/Plenum Press.
- Hayes, S. C. (1994). Content, context, and the types of psychological acceptance. In S. C. Hayes, N. S. Jacobsen, V. M. Follette, & M. J. Dougher (Eds.), *Acceptance & change: Content and context in psychotherapy* (pp. 13-32). Reno, NV: Context Press.
- Howell, A. J., Digdon, N. L., Buro, K., & Sheptycki, A. R. (2008). Relations among mindfulness, well-being, and sleep. *Personality and Individual Differences, 45*(8), 773–777.
- Hue, M. T., & Lau, N. S. (2015). Promoting well-being and preventing burnout in teacher education: A pilot study of a mindfulness-based programme for pre-service teachers in Hong Kong. *Teacher Development, 19*(3), 381-401.
- Inch, B., & Warnick, E. S. (1994). *Critical thinking and communication: The use of reason in argument*. New York, NY: Macmillan
- Irani, T., Rudd, R., Gallo, M., Ricketts, J., Friedel, C., & Rhoades, E. (2007). *Critical Thinking Instrumentation Manual*. Gainesville, FL.: University of Florida.
- Kennedy, M., Fisher, M. B., & Ennis, R. H. (1991). Critical thinking: Literature review and needed research. *Educational Values and Cognitive Instruction: Implications for Reform, 2*, 11-40.

- Kiliç, H. E., & Sen, A. I. (2014). Turkish adaptation study of UF/EMI critical thinking disposition instrument. *Education and Science*, 39(176), 1-12.
- Kohls, N., Sauer, S., & Walach, H. (2009). Facets of mindfulness—Results of an online study investigating the Freiburg mindfulness inventory. *Personality and Individual Differences*, 46(2), 224-230.
- Kong, F., Wang, X., & Zhao, J. (2014). Dispositional mindfulness and life satisfaction: The role of core self-evaluations. *Personality and Individual Differences*, 56, 165-169.
- Kong, S. L. (2001). Critical Thinking Dispositions of Pre-service Teachers in Singapore: A Preliminary Investigation: *The Annual Conference of the Australian Association for Research in Education (AARE)*. Australia: Fremantle.
- Lai, E. R. (2011). Critical thinking: A literature review. *Pearson's Research Reports*, 6, 40-41.
- Lau, M. A., Bishop, S. R., Segal, Z. V., Buis, T., Anderson, N. D., Carlson, L., ... Devins, G. (2006). The toronto mindfulness scale: Development and validation. *Journal of Clinical Psychology*, 62, 1445–1467.
- Leach, B. T. (2008). *Critical Thinking Skills as Related to University Students' Gender and Academic Discipline*. Retrieved from ProQuest Dissertations & Theses Global. (AAT 3462052)
- Lee, Y. K. R. (2016). *Teachers' Beliefs, Confidence and Practice and Students' Achievement in Cultivating Critical Thinking in Primary Music Education in Hong Kong*. Retrieved from ProQuest Dissertations & Theses Global. (AAT 10267915)
- Lewis, M. (2007, February 7). *Stepwise versus Hierarchical Regression: Pros and Cons*. Paper presented at Annual Meeting of the Southwest Educational Research Association, San Antonio. Online Submission.

- Litman, J. A., Robinson, O. C., & Demetre, J. D. (2017). Intrapersonal curiosity: Inquisitiveness about the inner self. *Self and Identity, 16*(2), 231-250.
- Lutz, J., Herwig, U., Opialla, S., Hittmeyer, A., Jäncke, L., Rufer, M., ... & Brühl, A. B. (2013). Mindfulness and emotion regulation—an fMRI study. *Social Cognitive and Affective Neuroscience, 9*(6), 776-785.
- McBride, R. E., Xiang, P., & Wittenburg, D. (2002). Dispositions toward critical thinking: The preservice teacher's perspective. *Teachers and Teaching, 8*(1), 29-40.
- Mok, F. K., & Yuen, T. W. (2016). A critical evaluation of the understanding of critical thinking by school teachers: the case of Hong Kong. *Citizenship, Social and Economics Education, 15*(1), 28-44.
- Murray, M. A., & Byrne, R. M. (2005). *Attention and working memory in insight problem solving*. In Proceedings of the xxvii annual conference of the cognitive science society (pp. 1571-1575). Mahwah, NJ: Erlbaum.
- National Commission on Excellence in Education. (1983). *A Nation at Risk: The Imperative for Educational Reform*. Retrieved from https://www.edreform.com/wp-content/uploads/2013/02/A_Nation_At_Risk_1983.pdf
- Niemiec, C. P., Brown, K. W., Kashdan, T. B., Cozzolino, P. J., Breen, W. E., Levesque-Bristol, C., & Ryan, R. M. (2010). Being present in the face of existential threat: the role of trait mindfulness in reducing defensive responses to mortality salience. *Journal of Personality and Social Psychology, 99*(2), 344-365.
- Nilgun, Y. (2011). Investigating pre-service science teachers' critical thinking dispositions and problem solving skills in terms of different variables. *Educational Research and Reviews, 6*(6), 497-508.

- Noone, C., Bunting, B., & Hogan, M. J. (2016). Does mindfulness enhance critical thinking? Evidence for the mediating effects of executive functioning in the relationship between mindfulness and critical thinking. *Frontiers in Psychology, 6*, 2043.
- Norris, S. P., & Ennis, R. H. (1989). *Evaluating Critical Thinking*. Pacific Grove, CA: Critical Thinking Press & Software.
- O'Fallon, M. J., & Butterfield, K. D. (2005). A review of the empirical ethical decision-making literature: 1996–2003. *Journal of Business Ethics, 59*(4), 375-413.
- Ohlsson, S. (1992). Information-processing explanations of insight and related phenomena. In M. Keane & K. Gilhooly (Eds.). *Advances in the psychology of thinking* (Vol. 1, pp. 1–44). London, OK: Harvester Wheatsheaf.
- Ostafin, B. D., & Kassman, K. T. (2012). Stepping out of history: Mindfulness improves insight problem solving. *Consciousness and Cognition, 21*(2), 1031-1036.
- Parasuraman, R. (1998). *The attentive brain*. Cambridge, MA: MIT Press.
- Pascarella, E. T., & Terenzini, P. T. (2005). *How college affects students: A third decade of research* (Vol. 2). San Francisco: Jossey-Bass.
- Pedhazur, E. J. (1997). *Multiple regression in behavioral research* (3rd ed.). Orlando, FL: Harcourt Brace.
- Posner, M. I. (1980). Orienting of attention. *Quarterly Journal of Experimental Psychology, 32*(1), 3–25.
- Ritchhart, R., & Perkins, D. N. (2000). Life in the mindful classroom: Nurturing the disposition of mindfulness. *Journal of Social Issues, 56*(1), 27-47.

- Roemer, L., & Orsillo, S. M. (2003). Mindfulness: A promising intervention strategy in need of further study. *Clinical Psychology: Science and Practice*, 10(2), 172-178.
- Roeser, R. W., Schonert-Reichl, K. A., Jha, A., Cullen, M., Wallace, L., Wilensky, R., . . . Harrison, J. (2013). Mindfulness training and reductions in teacher stress and burnout: Results from two randomized, waitlist-control field trials. *Journal of Educational Psychology*, 105(3), 787-804. doi:10.1037/a0032093
- Roeser, R. W., Skinner, E., Beers, J., & Jennings, P. A. (2012). Mindfulness training and teachers' professional development: An emerging area of research and practice. *Child Development Perspectives*, 6(2), 167-173.
- Ruedy, N., & Schweitzer, M. (2010). In the moment: The effect of mindfulness on ethical decision making. *Journal of Business Ethics*, 95, 73–87.
- Sadker, M., & Sadker, D. (2003). *Teachers, schools, and society* (6th ed.). New York: McGraw-Hill.
- Scott, J. N., Markert, R. J., & Dunn, M. M. (1998). Critical thinking: change during medical school and relationship to performance in clinical clerkships. *Medical Education*, 32(1), 14-18.
- Segal, Z. V., Williams, M., & Teasdale, J. D. (2018). *Mindfulness-based cognitive therapy for depression*. New York: Guilford Publications.
- Shapiro, S. L., Brown, K. W., & Astin, J. A. (2008). *Toward the integration of meditation into higher education: A review of research*. Retrieved from <http://www.contemplativemind.org/files/MedandHigherEd.pdf>
- Shapiro, S. L., Carlson, L. E., Astin, J. A., & Freedman, B. (2006). Mechanisms of mindfulness. *Journal of Clinical Psychology*, 62(3), 373-386.

- Shapiro, S. L., Jazaieri, H., & Goldin, P. R. (2012). Mindfulness-based stress reduction effects on moral reasoning and decision making. *The Journal of Positive Psychology, 7*(6), 504-515.
- Sharp, J. E., & Jennings, P. A. (2016). Strengthening teacher presence through mindfulness: What educators say about the cultivating awareness and resilience in education (CARE) program. *Mindfulness, 7*(1), 209-218.
- Slavin, R. (2009). *Educational psychology theory and practice* (9th ed.). Upper Saddle River, NJ: Pearson.
- Stapleton, P. (2011). A survey of attitudes towards critical thinking among Hong Kong secondary school teachers: Implications for policy change. *Thinking Skills and Creativity, 6*(1), 14-23.
- Stedman, N. L., & Andenoro, A. C. (2007). Identification of relationships between emotional intelligence skill and critical thinking disposition in undergraduate leadership students. *Journal of Leadership Education, 6*(1), 190-208.
- Sternberg, R. J. (1986). *Critical Thinking: Its Nature, Measurement, and Improvement*.
- Student Affair Office. (2018). *Graduate Employment Survey*. Retrieved from <https://www.eduhk.hk/sao/?p=219>
- Taber, K. S. (2016). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education, 48*(6), 1273-1296.
- Tang, Y. Y., Hölzel, B. K., & Posner, M. I. (2015). The neuroscience of mindfulness meditation. *Nature Reviews Neuroscience, 1*-13.

- Temel, S. (2014). The effects of problem-based learning on pre-service teachers' critical thinking dispositions and perceptions of problem-solving ability. *South African Journal of Education, 34*(1).
- Tishman, S., Jay, E., & Perkins, D. N. (1993). Teaching thinking dispositions: From transmission to enculturation. *Theory into Practice, 32*(3), 147-153.
- Tsui, L. (2002). Fostering critical thinking through effective pedagogy: Evidence from four institutional case studies. *Journal of Higher Education, 73*, 740-763.
- Wadsworth, B. (1971). *Piaget's theory of cognitive development from childhood to adolescence: A constructivist perspective*. New York: Holt, Rinehart, and Winston.
- Walach, H., Buchheld, N., Buttenmüller, V., Kleinknecht, N., & Schmidt, S. (2006). Measuring mindfulness—the Freiburg mindfulness inventory (FMI). *Personality and Individual Differences, 40*(8), 1543-1555.
- Walsh, C. M., & Hardy, R. C. (1997). Factor structure stability of the California Critical Thinking Disposition Inventory across sex and various students' majors. *Perceptual and Motor Skills, 85*, 1211-1228.
- Walsh, C. M., & Hardy, R. C. (1999). Dispositional differences in critical thinking related to gender and academic major. *Journal of Nursing Education, 38*(4), 149-155.
- Warren, L. (2006). Information literacy in community colleges: Focused on learning. *Reference and User Services Quarterly, 45*(4), 297–303.
- Watson, G., & Glaser, E. (2002). *Watson-Glaser Critical Thinking Appraisal, UK Edition: Practice Test*. New York: Psychological Corporation.
- Willingham, D. T. (2007). Critical Thinking: Why Is It So Hard to Teach? *American Educator, 31*(3), 8-19.

World Economic Forum. (2016). *The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution*. Retrieved from

http://www3.weforum.org/docs/WEF_Future_of_Jobs.pdf

Yang, Y. T. C. (2012). Cultivating critical thinkers: Exploring transfer of learning from pre-service teacher training to classroom practice. *Teaching and Teacher Education*, 28(8), 1116-1130.

Yeh, Y. (1997). *Teacher training for critical-thinking instruction via a computer simulation* (PhD Thesis, The Faculty of the Curry School of Education, University of Virginia).

Zhang, L. F. (2003). Contributions of thinking styles to critical thinking dispositions. *Journal of Psychology*, 137(6), 517-543. doi: 10.1080/00223980309600633

Appendix A
Information Sheet (English version)

INFORMATION SHEET

The Impact of Pre-service Teachers' Dispositional Mindfulness on
Their Critical Thinking Dispositions

You are invited to participate in a project supervised by Mr. LAM, Hiu Ming John and conducted by CHEN Ming, who are staff and student of Department of Psychology and Department of Mathematics and Information Technology at The Education University of Hong Kong respectively.

The present study aims at investigating the potential impact of Hong Kong pre-service teachers' level of dispositional mindfulness on that of critical thinking dispositions. Critical thinking includes various mental process such as multi-perspective thinking, openness to diverse opinions, reasoning justification and so on. Critical thinking disposition is one of the dimensions of critical thinking and it represents individuals' inner mental habit to think critically. Mindfulness requires full attention to the present moment with openness and nonjudgment, and dispositional mindfulness represents the inner motivation to be mindful. Both critical thinking dispositions and dispositional mindfulness play important role in teachers' job-related performances, and Hong Kong pre-service teachers are invited as the participants.

68 participants would be invited in the study. Participants would be recruited through advertisement at university intranet forums and social media (e.g., Wechat and Whatsapp), the website link of online survey would be attached in the advertisement, and participants could directly join in the survey by clicking on the link. Participants will be asked to finish a questionnaire, which might take 5 minutes. There is no potential benefit, but the data collected would inform the study well.

There is no potential risk. Your participation in the project is voluntary. You have every right to withdraw from the study at any time without negative consequences. All information related to you will remain confidential, and will be identifiable by codes known only to the researcher.

The results will be presented in form of thesis. There might be further dissemination such as journal articles and educational presentations, permissions are expected from you to share your results to larger audiences.

If you would like to obtain more information about this study, please contact me by email at _____@s.eduhk.hk or telephone number _____, or my supervisor Mr. LAM, Hiu Ming John by email at _____@edu.hk.hk.

If you have any concerns about the conduct of this research study, please do not hesitate to contact the Human Research Ethics Committee by email at hrec@edu.hk.hk or by mail to Research and Development Office, The Education University of Hong Kong.

Thank you for your interest in participating in this study.

CHEN Ming

Appendix B Information Sheet (Chinese version)

有關資料

準教師正念傾向水平對批判性思考傾向水平的影響

誠邀閣下參加林曉明先生負責監督，陳銘負責執行的研究計劃。他們分別是香港教育大學心理學系的教員和數學與資訊科技學系的學生。

本研究旨在研究香港準教師正念傾向水平對批判性思考傾向水平的影響。批判性思考包括了不同的精神流程例如多角度思考，對不同觀點的開放性以及辯證推理。批判性思考傾向是批判性思考的其中一個維度，代表著內在進行批判性思考的精神習慣。正念要求個體的包容和不帶偏見地專注於當下，正念傾向代表著正念的內在動力。批判性思考傾向和正念傾向對教師職場表現息息相關，因此香港的準教師被選為本研究的參加者。

68 名參與者將會被邀請參加本研究。參與者招募廣告將會被發佈在大學校內網站平台和社交媒體（例如 Wechat 和 Whatsapp）上，廣告中將包含有線上調查的鏈接，參加者可以直接點擊鏈接完成調查。參與者需要完成一個耗時 5 分鐘左右的問卷。是次研究並不為閣下提供個人利益，但所搜集數據將對研究學習動機的問題提供寶貴的資料。

本實驗不存在可能面對的風險。閣下的參與純屬自願性質。閣下享有充分的權利在任何時候決定退出這項研究，更不會因此引致任何不良後果。凡有關閣下的資料將會保密，一切資料的編碼只有研究人員得悉。

研究的結果將會以學士畢業論文的形式被呈現。在將來研究結果可能會以學術論文或教育陳述的形式傳播，希望能得到您的允許。

如閣下想獲得更多有關這項研究的資料，請以電郵(@s.eduhk.hk)或電話()與本人或本人的導師林曉明先生(@eduhk.hk)聯絡。

如閣下對這項研究的操守有任何意見，可隨時與香港教育大學人類實驗對象操守委員會聯絡(電郵: hrec@eduhk.hk; 地址：香港教育大學研究與發展事務處)。

謝謝閣下有興趣參與這項研究。

陳銘

Appendix C

Consent form (English version)

THE EDUCATION UNIVERSITY OF HONG KONG

Department of Psychology and Department of Mathematics and Information Technology

Appendix D

Consent form (Chinese version)

香港教育大學
心理學系及數學與資訊科技學系

參與研究同意書**準教師正念傾向水平對批判性思考傾向水平的影響**

本人同意參加由林曉明先生負責監督，陳銘負責執行的研究計劃。他們分別是香港教育大學心理學系的教員和數學與資訊科技學系的學生。

本人理解此研究所獲得的資料可用於未來的研究和學術發表。然而本人有權保護本人的隱私，本人的個人資料將不能洩漏。

研究員已將所附資料的有關步驟向本人作了充分的解釋。本人理解可能會出現的風險。本人是自願參與這項研究。

本人理解本人有權在研究過程中提出問題，並在任何時候決定退出研究，更不會因此而對研究工作產生的影響負有任何責任。

簽署:

參加者姓名:

日期:

Appendix E

Questionnaire

Critical thinking dispositions and dispositional mindfulness questionnaire

I am from: BEd Programme Non-BEd Programme BA&BEd Programme

Gender: Female Male Age: _____

Part A. Please choose the one that describes you best.

	Item description	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1.	I am a good problem solver	1	2	3	4	5
2.	I am confident that I can reach a reasonable conclusion	1	2	3	4	5
3.	I am able to relate to a wide variety of issues	1	2	3	4	5
4.	I am able to explain things clearly	1	2	3	4	5
5.	I am able to apply my knowledge to a wide variety of issues	1	2	3	4	5
6.	I present issues in a clear and precise manner	1	2	3	4	5
7.	I enjoy finding answers to challenging questions	1	2	3	4	5
8.	I am interested in many issues	1	2	3	4	5
9.	I look for opportunities to solve problems	1	2	3	4	5
10.	I ask focused questions when trying to clarify a solution	1	2	3	4	5
11.	It is important to be well informed	1	2	3	4	5
12.	I listen carefully to the opinions of others even when they disagree with me	1	2	3	4	5
13.	I believe that most problems have more than one solution	1	2	3	4	5
14.	I ask many questions when making a decision	1	2	3	4	5
15.	I consider how my own biases affect my opinions	1	2	3	4	5
16.	I try to understand the facts without letting my biases affect my decisions	1	2	3	4	5
17.	I try to find multiple	1	2	3	4	5

	solutions to problems					
18.	I can get along with people who do not share my opinions	1	2	3	4	5
19.	I am likely to change my opinion when I am given new information that conflicts with my current opinion	1	2	3	4	5
20.	I enjoy learning about many topics	1	2	3	4	5
21.	I will go out of my way to find the right answers to a problem	1	2	3	4	5
22.	I search for the truth even when it makes me uncomfortable	1	2	3	4	5
23.	I ask lots of questions in a learning environment	1	2	3	4	5
24.	I enjoy learning even when I am not in University	1	2	3	4	5
25.	I enjoy solving problems	1	2	3	4	5

Part B. Please choose the one that describes you best.

	Item description	Rarely	Occasionally	Fairly often	Almost always
1.	I am able to appreciate myself.	1	2	3	4
2.	In difficult situations, I can pause without immediately reacting.	1	2	3	4
3.	I am friendly to myself when things go wrong.	1	2	3	4
4.	I experience moments of inner peace and ease, even when things get hectic and stressful.	1	2	3	4
5.	I am open to the experience of the present moment.	1	2	3	4
6.	When I notice an absence of mind, I gently return to the experience of the here and now.	1	2	3	4
7.	I pay attention to what's behind my actions.	1	2	3	4
8.	I feel connected to my experience in the here-and-now.	1	2	3	4