Teaching And Learning Of Critical Thinking Skills: A Classroom Case Study

Shumaila Mahmood  
PhD, University of Southampton, UK. Assistant Professor  
Division of Education, University of Education, College Road, Township, Lahore.

Abstract

This study investigates the effectiveness of an intervention designed to develop critical thinking skills in an Initial Teacher Education (ITE) institution in Pakistan. The study carried out an explanatory sequential mixed-methods case study approach in which a quantitative inquiry phase was followed by a qualitative inquiry phase. A CT skills intervention was designed for an educational psychology module to be taught in an MA Education programme. The students’ motivation and self-regulation and classroom learning environment were studied as confounding variables. The results of the t-test revealed that experimental group did not gain any CT skills but rather declined over the time when the post-test was taken. The qualitative phase explained why the results were as is and unleashed the important connections between quality of teaching thinking skills, teacher effectiveness and the important role of students’ cognitive self-regulation and intrinsic goal orientation in conjunction with classroom learning environment are areas to focus on when designing teaching and learning of critical thinking skills.

Keywords: critical thinking skills, intervention, mixed methods research, case study, prospective teachers

Introduction

Teaching and learning of critical thinking skills has been a topic of interest for centuries. Despite the efforts the phenomena of becoming and being a critical thinker is still a myth and several kinds of perspectives are found in the field. Some agree that teaching of critical thinking skills is possible through curricular interventions, others believe that it is so hard to teach and must be emerging from a social and educational environment as a characteristic rather than a learned skill. Research has proven that CT skills are learnable provided the environment, instruction given that objectives of teaching and learning CT skills are precise.

Literature Review

This section mainly summarises research on teaching and learning of critical thinking skills
Research on teaching Critical thinking

The most promising meta-analytic studies on teaching thinking include Hattie, Biggs and Purdie (1996), Marzano (1998), Moseley et al. (2005) and more recently Abrami et al. (2008), Niu et al. (2013) and Huber and Kuncel (2015). The meta-analytic studies have helped to unravel some of the main areas of CT: 1) complexity of CT learning process; 2) the elements of learning environment; and 3) moderating variables involved in the learning of thinking skills and learning materials. It is important to consider these areas for a careful of thinking skills intervention design or in other words an instructional programme.

Multi-structural interventions use more than one strategy to teach CT skills. Hattie et al. (1996) found that only near transfer interventions were found moderately successful (M= 0.45) in this group. They appeared successful in improving performance and positive attitudes to study. However, they were not effective in improving study skills in near transfer. Interventions that are multi-structural and aiming at far transfer seem to have a negative effect on near performance; opposing positive gains were observed on study skills in far transfer (Hattie et al., 1996). This means that the effect of multi-structural interventions is more positive for developing study skills among students in the long run. An example of multi-structural intervention is that of Schunk and Gunn (1986) with the objective of improving self-efficacy and performance. They used task strategies to solve division problems; a comparison of pre- and post-test scores showed a substantial improvement as well as large direct influence of use of effective strategies on changes in division skills.

Similarly, Hattie et al. (1996) reported that comparatively relational interventions were systematically useful for overall outcomes; for instance, performance, affect, study skills, and in far or near transfer. Relational interventions are those that try to change student attributional perspectives towards learning by using multiple techniques.

Higgins et al. (2005) concentrated on studying such influences and synthesized the literature on curriculum-based interventions. This, in my opinion, is particularly important for instructional research because it deals with both the design of the learning plan and its execution. Directly, it involves planning an instruction programme, learning materials, assessment and learning environment. Indirectly, it involves the interaction of teacher, learner, content and classroom learning environment, and the very interaction of these in general. One distinguishing feature of Higgins et al.’s (2005) review is their focus on the holistic nature of intervention design; that is, careful selection and implementation of thinking skills approaches (named thinking skills programmes), as well as providing precise information on the effectiveness and efficiency of such approaches, hence providing reliable information on ‘what works’ in education. This raises the question of observing the learning environment and gathering empirical evidence on the extent to which factors in learning environment influence the learning of CT skills.

A plethora of literature is available on research on learning and instruction of high order thinking skills. Most promising meta-analytic studies on teaching thinking include Hattie et al., 1996, Marzano 1998, Moseley et al., 2005, and more recently Abrami et al., 2008, Niu et al., 2013 and Huber and Kuncel 2015. The meta-analytic studies have helped to unravel some of the main areas
of critical thinking 1) complexity of critical thinking learning processes, 2) the elements of learning environment and 2) moderating variables involved in the learning of thinking skills and learning materials. Considering these three areas for a careful design of thinking skills intervention or in other words instructional programme is important. In the following section the CT skills learning process, elements of successful or unsuccessful learning environments and moderators of the learning process where appropriate with relevance to teachers and improvement of teacher education are discussed.

CT skills learning process
Learning CT skills is consciously practicing strategies of thinking to become effective reflective thinker (Higgins 2015). Historically there have been various approaches recommended by researchers for various types, disciplines, age/education level and purposes. For example, most researches in 70s and 80s in the USA and Canada revolutionized the teaching and influenced development of thinking skills in schools (e.g. Lateral Thinking by de Bono, 1970; Project Intelligence by Machado, 1978; Instrumental Enrichment by Feuerstein et al. 1980; Advancement of Philosophy for Children by Lipman, Sharp, and Oscanyan 1980). These programmes can be considered pioneer influential programmes. Such ideas were then cross fertilised with an increased emphasis on the impact of various methods in developing CT skills in various parts of the world (Higgins 2015).

There has been little discussion about the theoretical and curricular aspects of CT skills research studies in literature. One researcher (Marzano 1998) has already drawn attention to the paradox in thinking skills instructional research and the lack of theory based models/curriculum to teach thinking. Equally, Sipe and Curlette 1997 found that the curriculum interventions mean effect size was higher than other educational treatment categories. Although they also noted that the dichotomy of lowest and highest effect sizes was also most present in curriculum interventions. The meta-synthesis revealed that instruction (amount and quality) aptitude (ability, development, motivation) and environment (home, classroom peer and television) have a direct influence on learning (affective, behavioural and cognitive).

The consideration of framework for thinking skills has been neglected in CT skills research study (Moseley et al., 2005). The research has reported that CT being complex as a learning skill needs theoretical and principled approach so that a systematic evidence can be established. This will help to unravel the ambiguities, the contextual, classroom level variables that hinder or encourage the provision of CT skills. In UK, Moseley et al., 2005 did the meta-analysis and represented a theory based results for thinking skills educational research. They reviewed fifty years of CT skills and instructional research field in social, cognitive and metacognitive aspects. They included 42 frameworks that can be used to promote CT skills in classrooms thus, providing a wide range of possibilities suiting various needs of local and institutional context. The selected frameworks were evaluated under description of intended use, evaluation and summary of the framework was provided. The frameworks for thinking have implications for practice and understanding such frameworks provided an understanding to plan the CT skills curricula. Their findings suggest that
the domain, content, process and psychological aspects of thinking, teaching and learning frameworks, approaches and methods are important to consider when designing CT instruction. Moseley et al., 2005 concluded that for thinking, learning and teaching a consistent and explicit use of theoretical framework is required within an educational or training context. The consistent use will reveal the complexities and effects and improvement which will be then direct benefit to teacher, learners as well as other stakeholders such as policymakers, parents, employers and educational research.

The processes of learning processes useful for complex cognitive skills can be used for selecting and designing critical thinking skills instruction. Another way to understand the thinking skills teaching and learning are the ways these can be taught across curriculum.

Pakistani context

The literature review above briefly explained the intricacies involved in the learning and instruction of CT skills. Although a substantial body of research is available on many aspects of CT skills instruction and learning, many other aspects still require further work. In particular, CT in teacher education in Pakistan is currently under-researched. Some research (Ashraf and Rarieya, 2008; Cassum et al., 2013; Iqbal and Shayer, 2000) has provided useful data in the Pakistani context, but both the quality and quantity of evidence are limited. The research recommendations called for further research to understand students’ expectation of what schooling involves, how ‘radical change in teaching style by substantial investment both in pre-service training and professional development time for teachers in Pakistan’ can be effected (Iqbal and Shayer, 2000, p. 272), and how reflective conversations with existing teachers might have the potential to bring improvements in teaching and learning practices in Pakistan (Ashraf and Rarieya, 2008). There is therefore a strong need to implement policy recommendations and bridge the gap between CT instructional theory and practice. The Pakistani context requires us to move beyond perceptional research towards evidence-based research in education, if practical changes are to be brought about in the quality of ITE. With this stance a curricular intervention was designed including the previous research recommendations for effective teaching of CT skills.

**Research Questions:**

The study primarily asked questions that

1: if a carefully designed intervention is successful or not in developing initial teacher education students’ critical thinking skills,

2: whether students’ motivation and classroom learning environment has any influence on their learning of CT skills.

3: how the experience of CT skills intervention and implementation was in this particular classroom.

**Methodology**
The methodology adopted was a sequential mixed methods design where after the empirical (quasi-experimental) phase the situation (classroom and participants) was studied deeply for a better understanding in the selected sample (Creswell, 2009). The intervention teaching lasted for four weeks and used a mixed approach (explicit and embedded) to teach CT skills. An explanatory qualitative phase was conducted as a follow-up to seek understanding and explanation after the intervention. The implementation observations were made to gauge the fidelity of the implementation, followed by qualitative interviews with participants. A Quant- Qual sequence was adopted for data collection. For quantitative phase research instruments were questionnaires to measure study variables such as critical thinking skills, students motivation/self-regulation and classroom learning environment. For the explanatory qualitative phase observations, field notes and interviews were used as tools. The data analysis was conducted and inferences were made to answer the research question.

Results

The comparison of control and experimental group’s pre and post tests showed no improvement in the experimental groups learning of critical thinking skills. Moreover, the gain was negative for experimental group, along with their motivation/self-regulation and classroom learning environment negatively associated with learning of critical thinking skills. The table 1, 2 and 3 show the results of t-tests and regressions for the main research questions.

Table 1: Independent sample t-test comparing intervention and non-intervention groups’ scores on pre- and post-tests of CT skills

<table>
<thead>
<tr>
<th>Test Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>27</td>
<td>4.56</td>
<td>1.8</td>
<td>3.79</td>
<td>54</td>
<td>.93</td>
</tr>
<tr>
<td>No-intervention</td>
<td>29</td>
<td>4.38</td>
<td>1.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>27</td>
<td>3.67</td>
<td>2.1</td>
<td>-1.153</td>
<td>54</td>
<td>.25</td>
</tr>
<tr>
<td>No-intervention</td>
<td>29</td>
<td>4.41</td>
<td>2.6</td>
<td></td>
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</table>

There is no effect from the CT skills intervention implemented for four weeks with two groups of students on an ITE first-semester MA class taking a module in educational psychology in a public teacher education university in Pakistan. The gain scores analysis further revealed a negative gain on experimental group students’ performance.

The results of the first phase were then compared with qualitative data and led to finding explanations of the unexpected results. The analysis of data through inferential statistics and content analysis helped to understand the phenomena of learning and instruction of CT skills in this study. For instance and important finding about the reason why students of experimental
groups actually declined was found through the observations and interviews that teachers instruction was not adequate and this led to a decline in student motivation.

Moreover classroom learning environment was not conducive for learning of CT skills and simple

Although the scales on student motivation and classroom learning environment did not significantly predicted or mediated the students’ post-test scores but the value added analysis of the subscales of these variables showed interesting data. For example, there was a significant linear relationship of the experimental groups’ learning of CT skills goal orientation, and metacognitive self-regulation aspect of motivation.

**Table 2: CT skills post-test scores as predicted by students’ metacognitive self-regulation and extrinsic and intrinsic goal orientation scales**

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extrinsic and intrinsic goal orientation</td>
<td>.445</td>
<td>.27</td>
<td>-.474</td>
<td>.30</td>
</tr>
<tr>
<td></td>
<td>(-.424, 1.314)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metacognitive self-regulation</td>
<td>-.716</td>
<td>.42</td>
<td>.188</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>(-1.272, -.160)</td>
<td></td>
<td></td>
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</table>

The study results suggest in learning of critical thinking skills equally important is the role of confounding variables. As demonstrated from the value added analysis the metacognitive self-regulation and intrinsic and extrinsic goal orientation aspects of all metacognitive learning strategies questionnaire are really important for this sample.

**Table 3: Relationship of students’ CT skills gain scores as predicted by students’ metacognitive self-regulation scale and learning environment questionnaire**
The value added analysis: links between cognitive self-regulation, intrinsic goal orientation with gain on critical thinking skills

The value-added analysis showed that there was a significant positive linear relationship between the cognitive self-regulation and extrinsic and intrinsic goal orientation component of students’ motivation/self-regulation with students’ CT skills post-test scores. The metacognitive self-regulation and classroom learning environment have a positive linear relationship with students’ gain scores. However, the nature of the relationship is negative, meaning the higher the student metacognitive self-regulation the lower students’ CT skills gain scores. The study also found that students’ post-test scores have a linear relationship with students’ metacognitive self-regulation and most CT components. In this sample, metacognitive self-regulation and learning environment showed an inverse relationship with students’ post-test scores and gain scores after the CT skills instruction. The linear relationship of students’ goal orientation, metacognitive self-regulation needs further attention and research in initial teacher education programmes for the development of CT skills.

Table 4: CT skills post-test scores as predicted by students’ metacognitive self-regulation and extrinsic and intrinsic goal orientation scales.

<table>
<thead>
<tr>
<th>Variables</th>
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</tr>
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<td></td>
<td>(-1.272, -.160)</td>
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</tbody>
</table>
Qualitative findings

The main themes that came out of structured observations (implementation fidelity) and unstructured observations (field notes) for assessing intervention effectiveness in a non-statistical way in this particular environment are shown below. What happens or how it is taught implementation fidelity (IF); and observing the classroom environment (OCE) is used to display the main themes. The following figure summarizes the themes that emerged from observational data analysis:

![Diagram showing main themes emerged from observation of IF and OCE]

Figure 1: Main themes emerged from observation of IF and OCE

Discussion and Conclusions

- Overall, six principles of intervention design elements were moderately present during the four weeks of lessons: subject specificity; a mixed approach; motivation (intrinsic and extrinsic)/self-regulated learning; constructivist student strategies (collaboration and group work); formative feedback (reinforcement and encouragement); and explicit teaching of CT.

- Other elements of instructional design were not consistently present throughout the intervention implementation time. Systematic steps of instruction were not followed, at times. The very first problem noticed by myself was lack of proper equipment or rather poorly maintained audio-visual aids and the teacher’s reluctance or lack of interest.

- The teacher did not seem to be professionally trained in methodology or competent enough to meet the demands of the modern-day teaching/learning environment. He seemed unprepared and came to class without preparation on most days. This teacher lacked basic presentation skills and computer literacy, and would stand in front of the screen blocking students’ view of the screen and struggle to run basic software, for example videos and PowerPoint presentations. On some occasions the class teacher ignored students’ questions and complaints. There was lack of feedback from the teacher. The class teacher tried to follow the student-centred instruction. It seemed as if it was difficult for him to break his habits.

- The teacher’s performance, technology resources, time management and pedagogical skills were poor, as were the motivation of both teacher and students and the contextual factors, for
example the novelty of the instructional intervention in this, a teacher education university.

The results of the study showed that there are several factors and variables that can hinder the effectiveness of an intervention. These include on the outside teacher’s effectiveness and teaching skills, implementation fidelity and on the inside the rigour of the intervention materials, learners motivation/self-regulation strategies and the complex interactions of teacher-student-learning materials. In order to provide successful learning and instruction of CT skills future studies will have to control for teacher variation, implementation fidelity.

Teaching critical thinking skills require commitment from the instructor. Classroom learning environment context matters and the teacher experience, age and position in carrier as well as teacher beliefs about CT skills can influence the commitment to teach critical thinking skills directly. Similarly indirectly, it influences students’ motivation to participate in complex tasks involving inquiry, probing questions and learning how to think. Therefore, teacher’s pedagogical practices and institutional commitment Matters to embody critical thinking skill designed into curriculum and infused into teacher pedagogy.

De Corte et.al., (2004) applied a multidimensional approach in the form of a CLIA (Competence, Learning, Intervention, and Assessment) for designing effective learning environments that foster literacy skills such as critical thinking, problem solving and self-regulated learning at university and school level. They asserted the importance of designing learning environments that require of teachers a range of competency skills (De Corte et.al., 2004). I think that this pays attention to the role of teacher training and the importance of providing such educational experiences as part of pre-service and in-service teacher education. On the other hand, the study invites thinking on what literacy skills are required and defined in different contexts; for instance, comparatively low-income countries will priorities literacy skills of basic competence compared to developed countries in which the focus will be on learning life skills and advanced forms of literacy, such as requiring students to be critical thinkers and self-regulated. Along with this, such ambitious teaching-learning environment calls for a change in learning culture. In terms of Pakistani teacher education, an awakened attention to improving the quality of education and quality of teachers in advanced literacy/competency skills has been explicitly in focus since 2009.

Future studies would require doing more mixed methods studies to discover the complexities underlying teaching of critical thinking skills at college and university level especially for initial teacher education students in Pakistan.

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