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## **PROMOTING PROSPECTIVE TEACHERS' CONSTRUCTIVE INVESTIGATION SKILL USING ACTIVITY BASED LEARNING**

### ***Abstract***

This study demonstrates the effects of Activity Based Learning (ABL) on the development of constructive investigation skill of 182 prospective teachers' while teaching the "Curriculum Development" course at a Teacher Education Institution in Pakistan. The study shows a real-life activity improves the participants' constructive investigation skill which promotes their deep learning of the course contents and makes the teaching-learning more interactive, effective, rewarding, and enjoyable.

**Key words:** Constructive Investigation Skill; Learner Centered Teaching; Activity Based Learning; Teacher Education

### ***Introduction***

Learning is a social process (Dewey, 1938) in which learners construct their knowledge representations in a form of mental models (Johnson-Laird, 1983). Learning becomes more effective, and meaningful when learners' involvement, participation and interaction are maximized (Fallows & Ahmet, 1999) through various activities (Jonassen & Churchill, 2004) that allow learners to experience procedural, operational, and sensational aspects of learning (Suydam, Marilyn, & Higgins, 1977). Such "hands-on experiences" transform learners' understanding into their

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personal knowledge that can be applied in other situations (Edward, 2001).

The commentators of constructive learning theory advocate that learning is a participatory process in which learners construct the meaning of learning object (s) /concept (s) using their sensory input and the prior knowledge (Dewey, 1916; Jonassen & Churchill, 2004). However, Piaget (1983) comments that discovery which aims to augment knowledge, resolve doubt, or solve a problem is the basis of learning. Taking into account the Piaget's comments about discovery, constructive investigation involves inquiry, knowledge building, and perseverance. It allows learners to integrate experiential learning with academic learning. It takes into account learners' previous knowledge and socio-cultural context and purposely engages them in a step-by-step exploration of new ideas, understandings, and mental growth through intellectual and real-life activities which promote their deep learning, problem solving, higher-order thinking, and reasoning skills.

Activity based learning (ABL) has emerged as 'Learning by doing' approach among the academic community. In place of teaching concepts, principles and procedures to promote declarative or procedural knowledge, as "constructivist" learning theory suggests (Hein, 1991), the ABL approach urges learners to construct mental models (Norman, 1983 & Mayer, 1989) through active participation. Learners' active, collaborative, and self-directed participation keep them motivated (Hake,1998) towards contextualizing their learning (Hull, 1999). It makes learning more pragmatic; enabling learners to solve complex, ill-structured and authentic problems (Mayer, 1989) and improves learners' power of knowledge retention (McKeachie, 1998).

In the ABL approach, students get involved actively in the learning process (Prince, 2004) and become autonomous learners

(Imtiaz & Asif, 2012). They use a variety of learning styles, like learning by doing, learning from mistakes, learning from honest and non-threatening feedback (Solomon, 2003). Teachers become 'delegator' who not only appreciate the students' autonomous and independent learning, but also facilitate them through encouraging, motivating, tutoring, providing resources without dominating the classroom or intimidating the learners (Frank, Lavy & Elata, 2003). These new roles improve students' engagement in teaching-learning process; hence, improve their deep learning and significant outcomes (Yam & Rossini, 2010).

Constructive investigation skill has an important role in an academic environment. It directly influences students' knowledge, skills, beliefs, and attitudes as learning is a social process (Ladd, 2005). Good constructive investigation skill is also critical to promote deep learning. Therefore, the development of prospective teachers' constructive investigation skill is very crucial. Activity Based Learning can be very useful for strengthening students' constructive investigation skill. In Pakistan, teaching of constructive investigation skill has never been a part of teacher education curriculum. This study is aimed to explore the potential of the ABL approach for promoting prospective teachers' constructive investigation skill while teaching the "Curriculum Development" course at a Teacher Education Institution in Pakistan.

### ***Constructive Investigation***

Commentators of constructive learning theory advocate that learning is a participatory process in which learners construct the meaning of learning object (s) /concept (s) using their sensory input and the prior knowledge (Dewey, 1916; Dewey, 1938). Whereas, the theory of "social constructivism" (Vygotsky, 1978) places more emphasis on social-cultural context. Knowles, et al.

(1998) argue that the learning process becomes more effective when a learner knows that “how learning will be conducted; what learning will occur; and why learning is important” (p. 133). However, Piaget (1983) believes that discovery which aims to augment knowledge, resolve doubt, or solve a problem is the basis of learning. He has further argued that discovery leads to understanding. Understanding is built up step-by-step through active involvement; learners have to go through stages and discover ideas, build relationships, and construct their mental models (Piaget, 1983).

In the light of above discussion, constructive investigation, on the one hand, can be considered as a process; on the other hand, it is a skill. As a process it can be defined as “an active process that takes into account learners’ previous knowledge and socio-cultural context and purposely engages them in a step-by-step exploration of new ideas, understandings, and mental growth through intellectual and real-life activities which promotes deep learning, problem solving, higher-order thinking, and reasoning skills.” As a skill, it can be characterized as learners’ ability to construct their mental models through step-by-step exploration of new ideas, understandings, and mental growth. The key object of constructive investigation is to make learners more responsible, initiator, thoughtful and collaborative.

Constructive investigation involves inquiry, knowledge building, and perseverance. It allows learners to integrate experiential learning with academic learning. Some activities of constructive investigation include:

- practicing constructive discussion to share ideas, reflections, and experiences;
- participating in group discussions for collaborative construction of knowledge;

- investigating micro and macro factors affecting knowledge creation process;
- practicing problem-solving and higher-order thinking skills;
- participating in collaborative and cooperative learning sessions to develop the relationship between semantic, episodic and action knowledge;
- sharing ideas and asking of questions to develop logical and conceptual meanings of abstract ideas/concepts;
- constructing conceptual models and reusing in different environments and activities.

Constructive investigation skill has an important role in an academic environment. Constructive investigation skill has an important role in an academic environment. Good constructive investigation skill is critical to promote students' deep learning. It also influences their knowledge, skills, beliefs, and attitudes as learning is a social process (Ladd, 2005).

Therefore, the development of prospective teachers' constructive investigation skill is very crucial. Teachers with strong constructive investigation skill would be in a better position to explore and implement creative ideas. In Pakistan, teaching of constructive investigation skill has never been a part of teacher education curriculum. This study is aimed to explore the potential of the ABL approach for promoting prospective teachers' constructive investigation skill.

### ***Activity Based Learning***

Philosophy of ABL can be traced back to late 20<sup>th</sup> Century when John Dewey started a university laboratory school at the University of Chicago. In this school, Dewey conducted various experiments to reform ways of teaching in schools for making

students active participants and creative. Dewey advocates that human exposures to life must be considered during the educational planning (Dewey, 1938). His initiative inspired many educationists who believed traditional teaching methods make students passive learners, as a result, learners could not associate new concepts with previously acquired learning (Teo & Wong, 2000). Consequently, many non-traditional methods of teaching emerged like Activity Based Learning (Prince, 2004 and Lijanporn & Khlaisang, 2015), Problem-Based Learning (Edens, 2000 and Tana, Van der Molenb and Schmidt, 2016), Project Based Learning (Diehl, et. al., 1999 and Lasauskiene & Rauduvaite, 2015), Collaborative Learning (Bruffee, 1993), Case-Based Learning (Barnes et. al., 1994 and Kantar & Massouh, 2015), Individual and Collaborative Game-based Learning (Ching-Huei Chen, V. L., 2016), Team-based Learning (Tweddell, Clark, & Nelson, 2016), Inquiry Based Learning (Suduc, Bizoi & Gorghiu, 2015).

In literature, a great variety of ABL research activities have been reported from different domains. These studies have demonstrated ABL makes teaching-learning processes more productive, interesting and understandable. For example, a study carried out on 2319 students from six mixed secondary schools in Ekiti State, Borode Bolaji. R. (2014) revealed that ABL used for essay writing appeared to be more effective on the attitude of students than lecture method. Hung, Jonassen and Liu (2008) argued that ABL has enhanced students' abilities to apply basic science knowledge in real-life, professional or personal situations. Similar findings are reported in studies from other domains like, teaching of elementary mathematics (Suydam & Higgins, 1977), teaching of physics class (Hake, 1998), teaching of commerce (Singh & Shilpi, 2012) teaching of medical education (Barrows and Tamblyn, 1980), teaching of physics at Secondary level (Hussain, et al. , 2011), teaching of basic and clinical sciences (Dochy et. al., 2003), teaching of biomedical (Shelton and Smith, 1998), learning

and understanding of scientific concepts (Thornton, 2001), teaching of research methods (Fallon, et. al., 2013), ABL in a vocational institution (Choo , 2007), and in higher education (Hmelo-Silver, 2004).

The ABL approach has also been practiced for developing higher order thinking skills (Polanco et al., 2004), improving long-term retention (Norman & Schmidt,1992), enhancing students' information management skills (Kaufman & Mann, 1996), handling complex situations (Martin et al., 1999), developing thinking and problem-solving skills (Gallagher et al.,1992), developing students' habits of reflection keeping (Karuna & Vinita, 2014), enhancing students' confidence and judging alternatives for solving problems (Dean,1999), improving self-directed learning, higher level thinking, and interpersonal skills (Schmidt et al., 2006), and teaching how to learn through different activities and real-life problems (Boud & Feletti, 1999).

Yet, some studies do not ready to accept the claims associated with ABL (Lieux, 2001; Colliver, 2000; Berkson, 1993; Eisensteadt et al., 1990; Zumbach et al., 2004; and Gallagher & Stepien, 1996). In fact, the effectiveness of ABL depends on many factors. Singh & Shilpi (2012) found a significant relationship between students' learning style and teachers' teaching style. Ladsen-Billings (1994) suggests that culturally relevant activities in teaching empower students socially, emotionally, intellectually, and politically. Thomas (2000) recommends that ABL activities should be interdisciplinary, curriculum based/related, student-centered, multi-stage and make the learners' learning experiences more conceptual, sociable, and rewarding. Edward (2001) suggests that learning activities based on real life experiences allow students to strengthen their personal knowledge base for handling real life scenarios. Chickering & Gamson (1987) have advised that students must talk about what they are learning, write about it,

relate it to past experiences, and apply it to their daily lives. They must make what they learn part of themselves.

### ***Objectives of the Study***

This research has following objectives.

1. To explore the potential of the ABL approach for promoting the constructive investigation skill of the prospective teachers while teaching the 'Curriculum Development' course.
2. To examine the participants' experiences of real life activities toward strengthening their constructive investigation skill.

### ***Methodology***

This study is carried out in two consecutive academic sessions (Fall 2009 & Fall 2010) at a teacher training institution, Lahore, Pakistan. The sample of the study consists of 182 students, 34 male and 148 female, enrolled in "Curriculum Development" course of M. A. Education degree program.

Session	Male (34)	Female (148)
Fall-2009-2011 (2 classes)	9	41
	11	39
Fall-2010-2012 (2 classes)	9	43
	5	25
Total	182	

The duration of activity was one semester, 18 weeks, including the midterm and final term examinations. During the study, the researcher taught this course to the prospective teachers. Learning was carried out performing a real life learning activity, "Sowing,



Growing and Harvesting Potato Crop”, aiming to invoke cognitive processes such as perception, knowledge construction, computational thinking, decision making, and retention. The aim of these real life experiences was to make it possible to bring together the ideas, interests and characteristics of the participants with the knowledge, skill, and experience of the researcher in a friendly environment.

Detailed instructions were given to the students before the starting of activity. The participants were urged and encouraged to co-relate their field experiences with central concepts, principles, models, and various processes of Curriculum Development course. All of the activities were monitored and evaluated.

### ***Theoretical Framework***

In the light of researcher’s previous experiences, the course of “Curriculum Development” remain a ‘dry’ subject causing very passive participation of students; causing hindrances to develop their deep learning of the course contents. In parallel, constructive investigation purposely engages students in a step-by-step exploration of new ideas, understandings, and mental growth through intellectual and real-life activities which promotes deep learning, problem solving, higher-order thinking, and reasoning skills. The commentators of constructive alignment advocates for teaching-learning activities and assessment tasks that directly address the learning outcomes intended in a way not typically achieved in traditional lectures, tutorial classes and examinations (Biggs, 1996). Therefore, it was decided to adopt the ABL approach for making teaching-learning process more interactive, interesting, effective and creative.

The next aspect was to find a way to implement the ABL approach. In this regard, the daunting challenge was to design an

innovative activity that could make students fully engaged, motivated, imaginative, and creative. As pure academic presentations, group assignments, and class discussions were found less effective, it was decided to design an activity which (i) matches with students' socio-cultural background, (ii) challenges students' constructive investigation skill, (iii) provides a friendly environment for students' independent learning and socialization, and (iv) must be safe, interesting, relevant, engaging, and provide a sense of belonging.

As the majority of the students were with an agricultural background, it was decided to engage students in a multistage activity -"Sowing, Growing and Harvesting Potato Crop":

- i. to develop their constructive investigation skills through co-relating various stages of the activity with central concepts, principles, models, and various processes included in the 'Curriculum Development' course;
- ii. to establish a friendly environment for step-by-step exploration and sharing information, observations, and experiences.

To know how well this new approach would be working, the Kirkpatrick evaluation model (Forsyth et al., 1999) was adopted. The model offers four evaluating levels: at Level 1, learners' feelings and opinions about the activity is evaluated; at Level 2, changes in knowledge, attitudes, and skills are evaluated; at Level 3, application of knowledge is measured; and level 4 measures changes in the organization. In addition, the researcher has used her observations as a tool for collecting information (Kawulich, 2005) about prospective teachers' level of participation. These observations also helped the researcher to implement the Kirkpatrick evaluation model for evaluating effectiveness of the activity.

The study has also used a five Likert scale (Oppenheim, 1966) questionnaire to obtain feedback from the participants. The designed questions divided into two banks. The questions included in the first bank addressed the following areas to characterize the participants' behaviour during execution of the activity:

- participation in the activity, group discussions, individual and group presentations;
- sharing of information, experiences, ideas, and course related information with peers;
- getting help of the instructor or peers for co-relating course contents with various stages of the activity;
- attitude towards asking questions if find difficulties in understanding course concepts;
- attitude towards individual/group assignments;
- opinion about activities.

Questions of the second bank addressed the following areas to characterize constructive investigation skill:

- Attitude towards co-relating field experiences with course contents.
- Attitude towards reading habit to look up further information to understand the course contents during the activity.
- Ability of cognitive load management for differentiating and filtering important information.
- Ability to understand concepts across multiple disciplines.
- Inquiry and computational thinking ability to understand a vast amount of information and abstract concepts.
- Social intelligence to sense and respond to others during social interaction.

- Sense making, flexible thinking and the ability to use of experiences to understand the meaning or significance of what is being experienced.
- Conversation & collaboration skills.
- Engagement in activities.

### *Findings*

In addition to the researcher's observation, a feedback was obtained through a five Likert scale questionnaire which was having two question banks. The study response was significantly encouraging. Between 71% and 100% of students answered positively to the questions asked in the first bank for characterizing their behavior during the activity:

- 78% of the participants found it very useful to participate in the activity, group discussions, individual and group presentations;
- 71% of the participants responded that it was very useful to ask a question to the instructor when they didn't understand new information, experiences, and ideas related to the activity;
- 100% of the participants said that it was very useful getting help of the instructor or peers in co-relating the course contents with various stages of the activity;
- 71% of the participants responded that the activity related assignments were very useful for understanding course concepts;
- 100% the participants had the opinion that the activities were interesting, rewarding, and a useful experience.

Similarly, from 58% to 98% of prospective teachers' have answered positively to the questions of second bank asked for

characterizing the participants' attitude towards the development of their constructive investigation skill:

- 98% of the participants find it challenging to co-relate activities with course contents.
- 87% of the participants responded that the new teaching methodology improved their reading habit to look-up further information to understand the course contents during the activity.
- 78% of the participants responded that the new teaching methodology improves their cognitive load management ability for differentiating and filtering important information.
- 70% of the participants responded that the new teaching methodology have improved their ability to understand concepts across multiple disciplines.
- 68% of the participants responded that the new teaching methodology has developed their inquiry and computational thinking ability to understand a vast amount of information and abstract concepts.
- 70% of the participants responded that the new teaching methodology has strengthened their social intelligence to sense and respond to others during social interaction.
- 58% of participants responded that the new teaching methodology was encouraging for sense making, flexible thinking and the ability to use their experiences to understand the meaning or significance of what is being experienced.
- 83% of participants responded that the whole activity was very useful for improving their conversation & collaboration skills.
- 98% of prospective teachers' responded that their engagement in activities increases their interest towards their course commitments.

### *Discussion and Reflections*

The findings of this study are evident from the participants' feedback; for example, one participant commented, "Now I understand how education can act as an element of social change. I wish other teachers should also take this type of initiative to educate us". Another participant commented, "Rote learning not only killed my creativity, but also shattered my confidence. This course has changed my life. I will use activity based learning when joins teaching profession." Another student said, "Madam, now I realized why constructive investigation is so important. If we do not know how to develop a concept we cannot understand what we are reading." Another participant commented, "This course has not only taught me concepts related to curriculum development, but also make me conscious about my constructive investigation skill which will help me in the rest of my life."

Although 98% of participants find it challenging to co-relate activities with the course contents, but they felt comfortable with the activity and found various opportunities for:

- Experiencing through observing, comparing, feeling, listening, talking, discussing, imagining, investigating, reporting,
- Memorizing through different modes of perception, finding regularities and patterns, connecting new experiences with previous knowledge,
- Understanding through, planning, predicting, judging, evaluating, interpreting, explaining, and applying knowledge and constructing their own knowledge constructs
- Socializing through developing a happy relationship between participants to participants and the instructor to participants.

These opportunities promoted the participants' constructive investigation skill through building up their habit of exploring

new concepts, co-relating learning experiences with academic concepts, sharing information with peers. At the same time, these opportunities made them more curious, more active, more social, more tolerant, more sympathetic, and more caring towards each other. It also made them more serious towards their course assignments.

During the activity and assessing the participants' work, it was found that the ABL approach appeared to be very useful for enhancing prospective teachers' knowledge of the course. The researcher also found that the participants showed more responsible, disciplined, and serious attitude towards studying the "Curriculum Development" course. They developed new learning habits, including analytical reading, creative thinking, discriminating and filtering information of importance. They have also realized the importance of active participation, collaborative learning, cooperative learning, and knowledge sharing in a learning environment. They also improved their discipline, project management, team management, leadership, interpersonal, presentation, and communication skills.

During the activity, the majority of the participants remained excited. Except some occasions, they demonstrated patience, tolerance, caring, collaboration, interaction, and sharing attitude towards each other. They left no stone unturned to make their efforts successful. Managing discipline remained a challenge for the researcher during the outdoor activities.

Keeping students motivated was another challenging area. Sometimes, stereotype teachers and students pass negative and harsh comments like, "you are growing curriculum; I've never seen doing this silly thing anywhere before". Such comments sometimes made students disappointed. However, these kinds of the participants' comments clearly reflect the effectiveness of the

ABL approach: "Similar to Potato cultivation activity, Curriculum Development was a new course for me. From this activity, I have learnt that like potato plants, curriculum is a living thing which requires proper planning, execution strategy, and teachers committed.

I have learnt that the students who took proper care of their plants got a lot of potatoes; whereas, the students who were irresponsible got nothing or less potatoes. Similarly, I can say that those teachers who planned and performed every action in time to get the required learning outcome, whereas those teachers who show irresponsible attitude ruin their students' future. 'Inshallah', in my teaching career, I will take care of each student as a farmer takes care of each plant." Another participant commented, "I am surprised; no one has told us about constructive investigation skill. I use to remember notes for reproducing in the examination. This activity has changed my concepts of education. Now I have learnt that constructive investigation skill is very important for developing deep understanding of the course."

This study finding supports the idea that real life activity based learning improves students' active participation which leads to improve their constructive investigation skills. The ABL approach worked on both aspects; constructive investigation as a process, and constructive investigation as a skill. As a process, it takes into account learners' previous knowledge and socio-cultural context and purposely engages them in a step-by-step exploration of new ideas, understandings, and mental growth through a real-life activity which have promoted their deep learning of the course contents. As a skill, it encourages the participants' ability to construct their mental models through step-by-step exploration of the multi-stages of the activity. The study has found that the students strengthen their deep learning through exploring new concepts step-by-step. In turn, they co-relate new learning



experiences with the academic concepts. They further enhanced their deep learning through sharing information and querying the peers and the teacher. It made them more curious, more active, more social, more tolerant, more sympathetic, and more caring towards each other.

The study also found that the following aspects directly influenced the students' constructive investigation skill:

- Attitude towards co-relating field experiences with course contents.
- Reading habit to look up further information to understand the course contents during the activity.
- Ability of cognitive load management for differentiating and filtering important information.
- Ability to understand concepts across multiple disciplines.
- Inquiry and computational thinking ability to understand a vast amount of information and abstract concepts.
- Social intelligence to sense and respond to others during social interaction.
- Sense making, flexible thinking and the ability to use of experiences to understand the meaning or significance of what is being experienced.
- Conversation & collaboration skills.
- Engagement in the activity.

The ABL approach has also offers very useful learning experiences. As an instructor of the course, the researcher found it challenging to maintain students' motivation and discipline. The negative remarks and discouraging comments of other teachers and fellow students made the participants de-motivated. Sometimes, participants shown a negative attitude when they find

difficulty in developing the relationship between activity experiences and course contents. Developing innovative and creative ideas to promote participants' knowledge, skills, and competence were time consuming and difficult. In parallel, lack of encouragement from other colleagues and the administration made the researcher disappointed, de-motivated, and depressed. But, during the activity, the researcher found three important motivating factors:

- (i) participants' continuous interaction with the instructor and peers,
- (ii) an active participation of the instructor in both outdoor and indoor activities, and
- (iii) a continuous feedback and encouragement from the instructor.

Also, during the course execution, the researcher felt more liberal, responsible, and conscientious. The role of facilitator and participant of open discussion sessions promoted the researcher's professional confidence and conceptual understanding of subject knowledge. Towards the end of this section, the study concludes that the encouraging results justify to driving a logical conclusion that the ABL approach is very effective to promote the participants' constructive investigation skill.

In spite of the above mentioned benefits, the ABL approach introduces additional workload on instructors such as additional preparation and assessment, extra time for activity monitoring and evaluation, extra sessions for guidance and counseling. These aspects may discourage teachers to adopt the ABL approach, particularly in situations where the teachers work load is calculated considering the number of courses to be taught. To promote the ABL approach, the administration of academic

institutions has to reconsider the teachers' workload calculation policy.

### ***Recommendations***

Real life activities which take into account learners' previous knowledge and socio-cultural context and purposely engage learners in a step-by-step exploration of new ideas, understandings, and mental growth promote their deep learning, problem solving, higher-order thinking, and reasoning skills. Step-by-step exploration of new ideas improves learners' ability to construct mental models; hence promotes their understanding. It also makes them more responsible, initiator, thoughtful and sociable. We believe these aspects are very critical for their professional and social development. In countries like Pakistan, teaching community need to address the teaching of construction investigation skill to build a strong knowledge base for making teaching-learning process more interactive and rewarding.

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