DESIGNING A CLASSROOM AS A LEARNER-CENTERED LEARNING ENVIRONMENT PROMPTING STUDENTS' REFLECTIVE THINKING IN K-12

Kyoungna Kim
Barbara L. Grabowski
Priya Sharma
Penn State University

Abstract

Only few studies have explicitly attended to the nature of the perceived underlying factors that prompt young adolescents' reflective thinking in association with K-12 learning environment. This paper focuses on an analysis of the factors that are perceived by young students as prompting their reflective thinking and how those factors apply to the practice of design. Given that technology can provide scaffolding for reflection (Lin,X., Hmelo, C., Kinzer K., Secules,T 1999) and given that without appropriate support students have difficulty engaging in high-level reflective thinking (Hmelo, C. E. & Lin, X. 2000), it is important to look at the design issues and elements that should be considered in supportive learning environment design (focused on K-12 learning environment). This paper examines and analyzes learner perceptions of the role of the learning environment elements including cognitive and affective scaffolding, instructional strategies, and tools as important in supporting their thinking. The factor analysis revealed seven dimensions of helpful cluster of learning environment elements. Four distinct dimensions of them are such as feasibility of other's supportiveness, flexibility, cognitive scaffolding and learner's independence. The most helpful factor was the feasibility of other's supportiveness with the most helpful clusters of elements as having other's help and teacher's individual caring and encouragement. Recommendations are provided for designing learning environments that prompt reflective thinking based on these results.

Introduction

The explosive growth and development of technology requires new knowledge and learning skills (Lin, Hmelo, Kinzer, & Secules, 1999). This explosion is reforming the learning environments and educational concepts. In particular, the growth of technology that includes the World Wide Web requires students to learn not only how to use resources to find relevant information but also how to make sense of information. Higher-order thinking skill is especially important when deciding which sources are useful and reliable (Lin et al, 1999). Therefore, in this new learning paradigm something other than "just thinking" is involved. In other words, it requires learners to be able to think reflectively and critically to manage information accessible via this new learning environment

With regards to the K-12 learning environment, it was discovered that young students perceived the learning environment as one of the most important factors that prompt and support their reflective thinking (Koszalka, Song, & Grabowski, 2002). In their research context, learning environments referred to the flexible learning climate where students have freedom in class, work with a partner, and have time to think. The use of the term "learning environment" is a narrow scope. In the current study, "learning environment" refers to the term more broadly as it is associated with K-12 classroom learning environments. It adds teachers' teaching strategy, supporting tools, learning climate, characteristics of learner-centered classroom, peers, and technology support. As to the student perception of their learning environment, there is research that revealed the importance of studying students' perceptions of classroom practices by illustrating the influence of student perceptions of personal climate in class on their motivation and classroom performance (Meece, 2003). According to Meece (2003), students' perceptions of classroom practices including teacher's teaching and students' learning atmosphere were predictive of student motivation and achievement. These findings, therefore, emphasize the importance of taking into account students' perceptions of teaching practice as well as the elements of a more narrowly defined learning environment.

From this perspective, it is important to look at the elements that should be considered in designing a supportive learning environment for students' reflective thinking. These include different

teaching strategies and scaffoldings, tasks, reflective thinking tools, atmosphere of learning environments, and technology-enriched classroom learning environments that can be provided in K-12 education. Taken together, as a part of this research, the student perception of their learning environments that prompt and support their reflective thinking was examined, which is important for teachers and instructional designers to apply to their design practice. In short, this study will examine and analyze both learner perceptions of the factors as important in prompting their reflective thinking and which characteristics of a learner-centered classroom are most important in supporting young-students' reflective thinking.

Theoretical Background

Factors Prompting Students' Reflective Thinking in K-12 education

Reflective thinking is defined by Dewey (1933): "Active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusion to which it tends.", and it is more relevant for ill-structured problems (King & Kitchener, 1994). In other words, reflective thinking is viewed as a thinking process reflecting specifically on the processes about what has happened. This process leads students to assess what they know, what they need to know and how they would learn the information to make judgments to construct learner's own knowledge.

When it comes to fostering reflective thinking in K-12 education, such other potentially important factors as teacher's teaching strategies and scaffoldings in class (i.e: question prompt, instructional strategies, and so on), tasks (i.e: making observations, asking question, and comparing their understandings with those posed by others, etc.) and tools (i.e: discussion, tutoring, and peer evaluation, etc.), and learning atmosphere (i.e: having freedom, time to think, etc.) must be considered. (Douillard, 2002; Koszalka et al, 2002; Wood, Bruner, and Ross, 1976).

Teaching Strategies and scaffolding: The role of the teacher in scaffolding students' learning is crucial to the development of reflective thinking not only while the students are engaged in the task but also in the creation of a learning environment that encourages young children to actively play and/or explore the objects and ideas that they encounter (Yelland, 1999).

Teachers can prompt students' reflective thinking by asking reflective questions as well as explaining reflective concepts to students (Moon, 1999; Virtannen et al, 1999). Asking questions that seek reasons and evidence can prompt students' reflection, and providing some explanations to guide students' thought processes during explorations can provide an opportunity to support their reflective thinking (www.higp.hawaii.edu/kaams/resource/reflection.htm).

Tasks: In class, when students are provided with authentic tasks involving ill-structured learning activities, challenging work and complex problem solving, they are prompted to use reflective thinking during learning (Hopson, Simms, & Knezek, 2001; Stepien & Pyke, 1997). John Dewey (1933) and King and Kitchener (1994) propose that individuals engage in reflective thinking when they encounter problems with uncertain answers, when no authority figure has an answer, when they believe no one answer is correct, and when the solution cannot be derived by formal logic.

In addition, the use of reflective thinking can be prompted while students are engaged in active learning, inquiry and problem-solving (Yelland, 1999). Sternberg (1985) also addressed that the use of higher order thinking skills and the use of metastrategic processes which requires students' reflective thinking are characteristics of effective problem-solving environments.

Yelland (1999) noted some characteristics of those learning activities:

- is authentic and therefore meaningful,
- is interesting and engaging,
- allows for initiative,
- can be discussed and summarized into statements that have meaning for students -allows the student to use what knowledge he or she knows and then explore new
- concepts, and
- does not have one path solution or has a variety of acceptable solutions.

Reflective Thinking Tools: The types of tools that scaffold students' reflective thinking such as reflective journal writing, guiding questions, and concept maps are important in fostering students' reflective thinking (Kinchin & Hay, 2000; in Koszalka et.al, 2002). There is a shared assumption of educators that reflective writing can promote reflective thinking (King & Kitchener, 1994; Ross, 1990). Providing students with keeping reflective journals to write down students' positions, give reasons to

support what they think, show awareness of opposing positions and the weaknesses of their own positions can foster students' reflective thinking (www.higp.hawaii.edu/kaams/resource/reflection.htm).

Learning Atmosphere: Learning atmosphere in which students engage in can be an important factor prompting their reflective thinking. Research shows that students perceive the student learning environment factor that includes flexibility as the most significant factor to help think reflectively (Koszalka, et al. 2002). In terms of K-12 education, the quality of the classroom climate even can influence their levels of achievement. According to Poplin and Weeres (1992), their research sums up this issue: "when students feel alienated and disconnected from the process of learning and from the social context of learning, levels of achievement are lowered" (p. 15).

A Classroom as a Learner-Centered Learning Environment

…….the perspective that couples a focus on individual learners (their heredity, experiences, perspectives, backgrounds, talents, interests , capacities, and needs) with a focus on learning (the best available knowledge about learning and how it occurs and about teaching practices that are most effective in promoting the highest levels of motivation, leaming, and achievement for all learners). ……The learner-centered perspective is a reflection of the twelve learner-centered psychological principles in the programs, practices, policies, and people that support learning for all. (p. 9)

Learner-centered learning environment: One very powerful type of classroom that supports reflective thinking is the learner-centered learning environment. Learner-centered attributes such as a more flexible atmosphere, time, and tasks, and peer tutoring activities are included in the learning environment design factors (Song, et al. 2002). In particular, when these design elements are associated with designing a learner-centered learning environment, they are perceived as important factors promoting students' reflective thinking by young students (Song, et al. 2002). Based on these research findings, there are some suggestions made for designing a classroom as a learning environment that supports and scaffolds students' reflective thinking. For instance, either teachers or instructional designers are recommended to take into account some flexible and affective scaffolding: providing enough wait-time for students to reflect when responding to inquiries, providing emotionally supportive environments in the classroom encouraging reevaluation of conclusion and providing students less-structured learning environment that prompts students to explore what they think is important (www.higp.hawaii.edu/kaams/resource/reflection.htm).

Interestingly enough, many of these design elements that are regarded as supporting reflective thinking environments overlap with the key characteristics of the learner-centered framework. Therefore, it is valuable to examine the design elements that are potentially influential to learners' perception of important factors prompting their reflective thinking. The following is a review of recent research on learner-centered classrooms, learner-centered psychological principles, and learning environment with both technological and non-technological support.

Importance of Learner-Centered Practices for students' reflective thinking in K-12:Learner-centered practices involve caring, establishing higher order thinking, honoring student voices, and adapting instruction to individual needs. Research findings that used survey data from 2,200 middle school students across the United States indicate many important benefits of learner-centered practices for young students: more positive forms of motivation and greater academic engagement (Meece, 2003). This implies the importance of learner-centered practices for young students' reflective thinking.

Based on the literature of reflective thinking and learner-centered learning environment, this study examined the following research questions:

1. What are the factors that are perceived by young students as prompting their reflective thinking?
2. Which characteristics of a learner-centered classroom are perceived as most important in supporting young-students' reflective thinking?

Method

Subject

A survey was administered to three-hundred fifty three sixth grade students attending an elementary school located in Korea. Students were from 9 different classrooms; including 199 boys, and 154 girls.

Instrument

The survey was constructed according to the rationale that students perceive elements related to their learning environments as important in prompting their reflective thinking (Song et. al, 2002). These attributes are composed of such elements as teachers' teaching strategies, peers, tools, and classroom climate. In particular, when these elements are present in the learner-centered learning environments, students perceived them as very important Since this study takes the assumption that the learner- centered practices will affect students' reflective thinking, 12 learning environment elements associated with learner-centered classroom practice McCombs, & Whisler (1997) suggested were added.

The survey for measuring the perceived factors related to reflective thinking was adapted from related research and developed by the author based on the literature of reflective thinking and learner-centered learning environment. The original instrument contained 10 items (Koszalka et al., 2002). Twelve more items relevant to the characteristics of students' learning environment were added. The final instrument consisted of 22 items that are scored on a 5-point Likert scale from strongly disagree (1) to strongly agree (5). The survey was reviewed for construct validity. The internal consistency reliability coefficients, Cronbach's alpha, for this version of the instrument that includes 22 items was .82 (n=353). In addition to internal consistency reliability coefficients, Table 3.3 contains estimates of the test-retest reliability of the questionnaire. These students responded to the questionnaire a second time approximately two weeks after the first administration. These calculations were based on data from a subsample of 38 sixth grade students in the sample school. The correlation (r) between the two tests computed from the test-retest correlations were also measured. The test and retest values computed from responses to the questionnaires were highly correlated ($r = 0.80$, $P < 0.0001$), thus indicating that the survey questionnaire displayed quite good test-retest reliability.

Data Analysis Procedure

The programmed SPSS-X package was used to process the data. The data were analyzed to answer the sub-questions of the problem statement. A principal component analysis with a varimax rotation was adopted to determine distinct learning environment element dimensions among the 22 items. Factor loadings were rotated using varimax rotation to identify the simple structure of the survey. Factor scores were derived. Pairwise deletion was used in the analysis of each survey to compensate for missing data. Reliability of the factor dimensions was computed through the reliability procedure in SPSS-X. The Cronbach alpha coefficient was referenced to assess level of reliability.

Results

Research Question 1 : What are the factors that are perceived by young students as prompting their reflective thinking?

In order to examine whether there were distinct learning environment factors that are perceived by sixth grade students as prompting their reflective thinking in Korea, a factor analysis approach was adopted. A principal component analysis with a varimax rotation was adopted to determine distinct factors prompting reflective thinking among 22 statements. This resulted in seven factors with an eigenvalue greater than one. Items with a factor loading of at least .40 were selected for each factor. Two items (Item No.3, No.16) loading of less than .40 were removed from the groupings. Cumulatively, the seven factors accounted for approximately fifty-five percent of the variance in the sample (Table 1). Cronbach Alpha coefficients were computed for the items that formed each factor. The coefficient for the seven factors ranged from .41 to .64.

The first factor was titled "**Feasibility of Others' Supportiveness/ adult intervention,"** due to the statement of which it was comprised. The statements were:

- having opportunity to work together with others not physically present (e.g: via email/ phone call contact)
- when teacher encourages shared decision making and gives us increasing responsibility for our learning
- when my teacher listens to and respects our points of view
- when my teacher monitors student progress continually and provides feedback on individual growth and progress.

Factor 1 was deemed most reliable (.64), accounted for 23% of the variance and had an overall mean of 3.79.

Factor two, titled **"Flexibility,"** loaded three statements:

- Working on activities in class that have many different answers,
- Having time to think about a question before answering, and
- Having freedom in class to explore topics I am interested in.

This factor had a coefficient reliability of . 50, accounted for 6.4% of the variance, and had an overall mean of 3.78.

The third factor, "**Cognitive Scaffolding**," was comprised of four statements, they included:

- drawing pictures to illustrate my understanding of a topic,
- when my teachers presents us with examples and expects us to generate rules,
- when my teacher presents us with the rules using pictures, and
- when my teacher encourages us to form mental connections between concepts.

A little less important than the previous factor (mean= 3.54), this factor was less reliable (.50) and accounted for 5.8 % of the variance.

The fourth factor, titled **"Independence,"** included four statements:

- when my teacher asks me how to solve difficult tasks,
- working with partners during classroom activities,
- answering questions about a topic, and
- working on complex and challenging activities that promote conceptual and analytic thinking.

This dimension contributed very little (5.3%) to the overall variance, had a mean of 3.62 and was deemed reliable with an alpha of .58.

Factor 5 titled **"Alternatives"** appeared to be related to alternative approaches of teaching and learning was comprised of two statements:

- when standardized and alternative forms of assessment are used help me think more what I'm studying,
- having opportunity for peer teaching as part of instruction helps me think more what I'm studying

A little less important than the flexibility factor (factor 1, M=3.79) and as important as the feasibility factor (factor 2, M= 3.74).

Factor 6 **"Reflection process"** appeared to relate the scaffolding the process of reflection itself by having students get involved with the reflective activity. The questionnaire items included statements as follows:

- Writing about my understanding of a topic helps me think more what I'm studying
- Having continuous communications with each other that extends beyond the class lessons helps me think more what I'm studying

This factor had a coefficient reliability of . 45, accounted for 4.9 % of the variance, and had an overall mean of 3.38.

Factor 7 seemed quite different from the previous researches regarding the dimension. According to <The APA Learner-Centered Psychological Principles> (1997), which has been categorized into social developmental factors. In this study,

- "working on activities in class related to real problems on earth or in our society"

element is separated by itself, and it is titled as **"Reality"** related to the characteristic of the task students are involved with. This factor had accounted for 4.9 % of the variance, and had an overall mean of 3.38.

Table 1. *Learning Environments Elements Dimensions Resulting From Factor Analysis*

	Learning Environment Elements Statements	**1**	**2**	**3**	**4**	**5**	**6**	**7**
MOTIVATIONAL AND AFFECTIVE FACTORS **(Feasibility of Other's supportiveness)**	14.having opportunity to work together with others not physically present (e.g: via email/ phone call contact) (n=350)	**.601**						
	18.when teacher encourages shared decision making and gives us increasing responsibility for our learning (n=349)	**.610**						
	19.when my teacher listens to and respects our points of view(n=352)	**.705**						
	20.when my teacher monitors student progress continually and provides feedback on individual growth and progress (n=350)	**.538**						
	Overall mean=3.74							

MOTIVATIONAL AND AFFECTIVE FACTORS **(Flexibility)**	1.Working on activities in class that have many different answers (n=353)		**.720**					
	6.Having time to think about a question before answering (n=352)		**.498**					
	7.Having freedom in class to explore topics I am interested in (n=352)		**.583**					
	Overall mean=3.79							
COGNITIVE AND METACOGNITIVE FACTORS (**Cognitive scaffolding**)	8.Drawing pictures to illustrate my understanding of a topic (n=352)			**.605**				
	11.when my teachers presents us with examples and expects us to generate rules (n=352)			**.595**				
	12.when my teacher presents us with the rules using pictures (n=352)			**.578**				
	15.when my teacher encourages us to form mental connections between concepts (n=348)			**.654**				
	Overall mean=3.55							
DEVELOPMENTAL AND SOCIAL FACTORS (**Independence**: learner-controlled instruction, , peer collaboration, etc.)	4.when my teacher asks me how to solve difficult tasks (n=352)				**.617**			
	5.working with partners during classroom activities (n=352)				**.433**			
	10.answering questions about a topic (n=350)				**.432**			
	17.working on complex and challenging activities that promote conceptual and analytic thinking (n=352)				.727			
	Overall mean= 3.45							
INDIVIDUAL DIFFERENCES FACTORS **Alternatives**	21.When standardized and alternative forms of assessment are used (n=350)					**.760**		
	22. Having opportunity for peer teaching as part of instruction (n=351)					**.548**		
	Overall mean=3.74							
Reflection process	9. Writing about my understanding of a topic						**.468**	
	13.Having continuous communications with each other that extends beyond the class lessons						**.742**	
	Overall mean= 3.38							
SOCIAL FACTORS **Reality**	2.Working on activities in class related to real problems on earth or in our society (n=353)							**.764**
	Overall mean= 3.65							
	Eigenvalue	5.06	1.40	1.27	1.17	1.13	1.07	1.00
	Variance Explained	23.0	6.36	5.76	5.32	5.10	4.86	4.57
	Cumulative Variance	23.0	29.4	35.2	40.5	45.6	50.5	55.0
	Alpha	.65	.50	.60	.58	.41	.45	

Note. 1. Only loadings greater than .4 are displayed.

Research Question 2 Which characteristics of a learner-centered classroom are perceived as most important in supporting young-students' reflective thinking?

Twelve different learning environment elements that are characterized on a learner-centered classroom were listed on the questionnaire. (Refer to Table 2) Sixth grade students were asked to rate the helpfulness of the each element they perceive as important. To calculate means and standard deviations for the relative helpfulness rating of each learning environment element, category responses was converted to numeric values, using a 5-point scale. The closer each mean approximated the value of 5, the higher the mean helpfulness utility rating for the learning environment elements. From an examination of the means, the following learning environment elements that have learner-centered characteristics were listed from "the *most" to "the least helpful* learning environment elements supporting for their reflective thinking. (Table 2)

In terms of the supportive learning environment elements that are associated with the characteristics of a learner-centered classroom, five elements ranked high are related to the MOTIVATIONAL AND AFFECTIVE FACTORS such as Factor 1, "Feasibility of other's supportiveness/

adult intervention" and Factor 2, "Flexibility" that includes "allowing different answers, having time to think, and having freedom in class to explore topics."

Table 2. *Learner-Centered Learning Environment Elements*

Item No.	Items reflecting the characteristics of the learner-centered classroom	Factor*	Mean
19.	When my teacher listens to and respects our points of view, it helps me think more about what I am studying.	1	3.90
7.	Having freedom in class to explore topics I am interested in helps me think more about what I am studying.	2	3.88
16.	Having opportunity to create and present whole relationship between what we see, hear, or read and what we already know and what we has been learned helps me think more about what I am studying.	.	3.82
20.	When my teacher monitors student progress continually and provides feedback on individual growth and progress, it helps me think more about what I am studying.	1	3.81
6.	Having time to think about a question before answering helps me think more about what I am studying.	2	3.78
18.	When teacher encourages shared decision making and gives us increasing responsibility for our learning, it helps me think more about what I am studying.	1	3.74
21.	When standardized and alternative forms of assessment are used, it helps me think more about what I am studying.	5	3.74
22.	Having opportunity for peer teaching as part of instruction helps me think more about what I am studying.	5	3.74
4.	When my teacher asks me how to solve difficult tasks it helps me think more about what I am studying.	4	3.58
14.	Having opportunity to work together with others not physically present (e.g: via email/ phone call contact) helps me think more about what I am studying.	1	3.52
17.	Working on complex and challenging activities that promote scientific and logical thinking in class helps me think more about what I am studying.	4	3.31
13.	Having continuous communications with each other that extends beyond the class lessons helps me think more about what I am studying.	6	3.30

*Note: Factor 1= Feasibility of other's supportiveness, 2= Flexibility, 3= Cognitive scaffolding, 4= Independence, 5= Individual differences, 6= Reflection process

Conclusions and Suggestions for Further Research

This research study was based on the premise that students can provide valuable information about their learning environment elements that prompt their reflective thinking; by listening to students, educators, teachers, and instructional designers may be able to enrich the learning environment to support students' reflective thinking.

This study identified seven learning environment design factors that a sample of young adolescents perceived as helpful in prompting their reflective thinking while studying. The factors perceived by sixth grade students in Korea were: *MOTIVATIONAL AND AFFECTIVE FACTORS* including (1) "feasibility of Other's supportiveness/Adult intervention" (having opportunity to work together with others not physically present, teacher's affective encouragement), and (2) "flexibility" such as allowing different answers, having time to think, and having freedom in class to explore topics, were the most very important as helpful for their thinking. The rest of the seven factors are as follows: (3) "cognitive scaffolding" (drawing pictures, teachers' presenting examples, rules, etc.) (4) "independence" (learner-controlled instruction, teacher's raising student's curiosity, peer collaboration, challenging task, searching, inquiry activity), and (5)"Alternatives" (alternative forms of assessment and peer teaching opportunity), (6) "Reflection Process", and (7) "Reality". *The motivational and affective factors* factor included in this study were perceived as most helpful. *The cognitive scaffolding factor* was perceived as least helpful.

One of the most meaningful findings in this study was the perceived importance of learner-centered practices in K-12 education. Most of learning environment elements that were highly regarded as helpful were aligned with the characteristics of learner-centered classrooms. Given that *the feasibility of other's supportiveness* and *flexibility* factor reflecting young adolescents students' motivation and affective

factor suggested APA (1997) were emerged as the most helpful factor, this study results support the idea that without appropriate support, young students have difficulty engaging in high-level reflective thinking(Lin et. al., 1999; Hmelo, & Lin, 2000). In addition, as expected, the fundamental assumption of this study that "the characteristics of the learner-centered classrooms including affective scaffolding should be perceived as important in young student's reflective thinking in K-12" was supported. These results have implications related to the young adolescents ' distinctive developmental stages that are characterized on "independence" as well as "dependence".

More research is needed to investigate what are the features that prompt students ' reflective thinking. Also, further research is needed to examine how both instrumental design principles and technology design features can be incorporated to provide a learning environment that supports and scaffold teachers ' instruction as well as students ' learning in K-12.

In addition, to design a classroom as a technology-enhanced, student-centered learning environment, more researches on the implied role and effect of technology for supporting students ' reflective thinking as well as on the students ' perception of the impact of technology will be needed.

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