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# Inquiry-based Learning in Indonesia: Portraying Supports, Situational Beliefs, and Chemistry Teachers' Adoptions

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## ABSTRACT

This study aimed at portraying the implementation of inquiry-based chemistry learning in the city of Jambi, Indonesia during the curriculum reformation era. The study included pre-existing supports for and situational beliefs towards the use of the strategy. The results of a questionnaire (n=99) revealed that inquiry had been minimally adopted in these areas. Improper supports and beliefs were identified and significantly contributed ($p< .05$) to the low adoption of the strategy ($r= .56^{**}$, $\beta= .32$; and $r= .57^{**}$, $\beta= .35$). These findings might explain the limited success of the Indonesian curriculum and low science achievement of the Indonesian students in the Program for International Student Assessment (PISA). This study recommends that the supportive learning conditions are needed to promote the teachers shift their own instructional strategies and improve the Indonesian students' science competencies.

**Keywords:** Beliefs on IbL, chemistry teaching, inquiry-based learning, supports for IbL.

## INTRODUCTION

Inquiry-based learning (IbL), as a well-known learning strategy, has attracted many educational researchers' and practitioners' attentions. The results of the studies investigating the effectiveness of this strategy have shown that this strategy is powerful in promoting diverse learning outcomes (see Gallagher, 1987; Geier et al., 2008; Hmelo-Silver, Duncan, & Chinn, 2007; Hofstein & Lunetta, 1982; Hofstein, Navon, Kipnis, & Mamlok-Naaman, 2005; Lustick, 2009; Palmer, 2009; Sadeh & Zion, 2009; Zion, Cohen, & Amir, 2007). For example; these outcomes include the development of students' active thinking skills and conceptual understanding (Minner, Levy, & Century, 2010), students' abilities to formulate hypothesis and questions (Hofstein, Shore, & Kipnis, 2004), and students' science

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performance levels (Sadeh & Zion, 2009). This strategy calls for engaging students in taking part in more independent learning processes. Teachers need to dominantly use divergent questions to guide students to successfully complete the lesson (Alessandrini & Larson, 2002; Oliveira, 2010; Windschitl, 2002).

Given the benefits of the IbL, many curricula around the world (e.g., the United Kingdom--IGCSE, 2009; Australia-- Anonim, 2007; the United States of America--NRC, 1996, 2000; China--MOE, 2001; and Indonesia--MoNE, 2003b) have recommended it. Particularly, the Indonesian curricula (MoNE, 2003b) have recommended the use of the IbL in science teaching activities during the curriculum reformation era, e.g., competency-based curricula (*Kurikulum Berbasis Kompetensi* or *KBK* and *Kurikulum 2013 or K13* in *bahasa)* released in 2003 and 2013 respectively. Hence, they purpose to develop the Indonesian students' science competencies through the use of the IbL. A translated guideline for the implementation of *KBK* says that:

> “It is advisable that science/chemistry should be taught with appropriate methods [in practicum]. It is thus essential to use such constructivism approach as inquiry-based learning while teaching abstract concepts” (MoNE, 2003b, p.12).

Despite of the recommendations in the science curricula, the implementation of the IbL in Indonesia has still been low. The results of a previous study with 70 science teachers (chemistry, physics, and biology) in the city of Jambi-Indonesia reported that most of the teachers neglected the IbL in their classes. Also, they determined that the teachers mostly used traditional science teaching practices such as lecturing (Effendi-Hasibuan, Harizon, Ngatijo, & Mukminin, 2019). The limited use of the IbL in Indonesia may have influenced the Indonesian students’ low science achievement levels in a well-known international science assessment called the PISA. The results of the PISA have revealed that the Indonesian students have possessed low science competencies. Interestingly, their science competencies have not been developed since 2003 (OECD, 2003, 2009, 2012, 2015).

Proper supports critically facilitate teachers to use inquiry. The previous study (Effendi-Hasibuan, M.H., et. al., 2019) also found that low supports impeded the science teachers’ use of the IbL in science teaching practices in the city of Jambi. The minimal supports of the IbL included limited time, large number of students, lack of facilities, knowledge, skills and experiences (Effendi-Hasibuan, M.H., et. al., 2019). The constraints identified by previous authors include the content-overloaded curriculum (Dai, Gerbino, & Daley, 2011), time limitation (Dickson, Kadbey, & McMinn, 2016), minimal educational facilities (Coppola, 2008; Dai, et al., 2011; Dickson, et al., 2016; Sundberg, Armstrong, Dini, & Wischusen, 2000; van den Berg & Lunetta, 1984; Zion, et al., 2007), minimal funding and technical support (Dickson, et al., 2016), classroom management problems (Thair & Treagust, 1999, 2003; van den Berg & Lunetta, 1984), overloaded classroom population (Dai, et al., 2011), IbL-detached assessment system (Chen, 1999; Cook & Taylor, 1994; Dai, et al., 2011), lack of teachers’ pedagogical content knowledge, skills, and experiences (Dai, et al., 2011; Deters, 2004; Dickson, et al., 2016; Thair & Treagust, 1997), and students’ poor skills in conducting practical inquiry-based activities (Dai, et al., 2011).

Suitable educational supports and belief systems are also significant in encouraging teachers to use the IbL in science teaching. Teachers’ beliefs determine their teaching tasks and organize their knowledge/reactions to those tasks (Nespor, 1987). Belief systems are one of the important factors influencing teachers’ views of their professions (Kagan, 1992). Further, beliefs are more effective in influencing teachers’ classroom decisions than their academic knowledge and capabilities (Nespor, 1987; Pajares, 1992; Wallace & Kang, 2004).

Belief systems consist of personal judgments, evaluations, and assessments towards learning situations (Luft & Roehrig, 2007; Nespor, 1987). Teachers believe that the IbL only works well in an appropriate learning situation (i.e., sufficient facilities, adequate time, classrooms with ideal population, etc). Because teachers believe that their students are unable to conduct the IbL (Colburn, 2000), they prefer using direct instructional techniques such as lecturing, rote learning, and drilling to nurture their science competencies (Cronin-Jones, 1991). Teachers' views of science cover a body of knowledge (Brickhouse, 1990; Duschl & Wright, 1989; Gallagher, 1991) containing facts, principles and concepts (Tobin & Mc Robbie, 1996). Consequently, this situation draws teachers to see their roles as a content-transmitter rather than a facilitator (Tobin & Mc Robbie, 1996). Finally, teachers may not feel any enjoyment in doing inquiry as a part of science curriculum (Brickhouse, 1990; Brickhouse & Bodner, 1992; Pajares, 1992). These beliefs, called *situational beliefs,* likely contribute to teachers' decisions of using the IbL in their daily teaching practices.

Given the foregoing descriptions of the beliefs, educational supports and teachers' situational beliefs obviously affect their adoptions of the IbL. Therefore, a study should investigate the extent to which the IbL is adopted in science classrooms. The study also ought to examine two factors affecting the implementation of the IbL, and the relations between these factors and the adoption of the IbL.

### *Purpose and Questions*

As a part of a large project investigating the appropriateness of the IbL in chemistry learning and possible constrains in Indonesia, this study involved chemistry teachers. Therefore, the purpose of this study was to portray the implementation of the inquiry-based chemistry learning in the city of Jambi city, the possible factors (i.e., available educational supports for the use of the IbL and teachers' situational beliefs towards the use of the IbL), and the relations between these factors and the adoption of the IbL affecting its applicability. The following questions guided the current study:

1. Do chemistry teachers implement the inquiry-based chemistry learning in practicum?
2. Are educational supports available for the adoption of the IbL?
3. What situational beliefs do the teachers hold at the inquiry-based chemistry learning?
4. Is there any relationship amongst educational supports, situational beliefs, and the adoption of the IbL?

## METHODS

### a) Research Design and Participants

Through a survey design, this study was conducted with 107 chemistry teachers (27 males and 80 females; aged 20-58 years; 1-30 years teaching experiences with bachelor and master degrees) drawn from public/state schools in the city of Jambi in early 2018. To collect data, a questionnaire was administered to them. The returned questionnaires were collected in a month with a full returning rate. This study had passed the ethical clearance protocol in the University of Jambi and requested the teachers to fill in consent forms.

### b) Data Collection Tools and Analysis

The questionnaire initially contained 25 items within a three-dimensional construct coping with Research Questions 1-3: (1) teaching practices and the implementation of the IbL, (2) available educational supports to use the IbL, and (3) teachers' situational beliefs towards the use of the IbL. Given related literature, this study established relevant definitions, indicators, and items for further process.

The items were constructed using clear sentences (in *Bahasa*) to avoid bias. The questionnaire consisted of a multiple response item (Q1.1) that enabled the teachers to cite more than one answer about their regular practices in chemistry teaching and six items with five-level ordinal question (Q1.2-Q1.7) encouraged the teachers to report their regular teaching approaches and frequency use of several strategies (see Table 1). The questionnaires also consisted of seven items with five-level ordinal question (Q2.1 – Q2.7) encouraged the teachers to report pre-existing educational supports for the use of the IbL (see Table 2), and ten items with a four-point Likert scale (Q3.1 – Q3.10) that encouraged the teachers to express their agreement and disagreement levels regarding their situational beliefs of the use of the IbL (see Table 3). Lastly, an open-ended question (OQ) that enabled the teachers to share their opinions and reflections of the implementation of the IbL in their schools was also employed in the questionnaire. To ensure content validity, an expert from the department of chemistry education at the University of Jambi was invited. This process was continued with member-checking, discussions, and revisions to produce the final trustworthy of the questionnaire.

A pilot-study was then carried out with 30 science teachers in the city of Jambi to obtain construct validity (item-total correlation and internal consistency tests via SPSS-20) of the 23-item questionnaire. Meanwhile, the tests were not applicable for the multiple response item (Q1.1) and the open-ended question (OQ). The results of the tests showed that Q1.4 (the teachers' frequency use of discussion-based learning per month), Q1.5 (teachers' frequency use of practicum-based learning per month), Q1.6 (the teachers' frequency use of information, communication, and technology-assisted learning per month), and Q2.6 (the teachers' workloads towards the adoption of the IbL) were respectively invalid ($p > .05$) and consequently removed from the list (see Tables 1 and 2). As a result, 19 valid ($p < .05$) and reliable items (Cronbach $\alpha$ =.61, .75, .66 for each dimension) were apparent and with the multiple response item (Q.1.1) and the open-ended questionnaire (OQ) concluded a total of 21 items of questionnaire. Then, the questionnaire was administered to the above-mentioned 107 chemistry teachers. However, only 99 of 107 (92.5%) teachers (called R1, R2, and so forth) was accepted for their serious involvement in the questionnaire (individual $SD \geq .3$). The quantitative data from 20 items were analyzed using descriptive (total, mean, and standard deviation) and multiple regression technique, while the data from the open-ended question (OQ) were exposed to a thematic coding procedure.

## RESULTS AND DISCUSSION

### a) The adoption of the IbL in chemistry teaching practices (Research Question 1)

As seen from Table 1, only a small number of the chemistry teachers, who reported their use of the IbL (f: 5), while frequencies of such strategies as discussion-based learning, conventional experiment, demonstration, and information, communication and technology (ICT)-assisted learning were between 8 and 22. Surprisingly, majority of the chemistry teachers predominantly used direct instruction strategies (i.e., lecturing and drill/exercise) in chemistry teaching (f: 99 and 41 respectively). Descriptive statistical results of the use of direct instructions were 2.14 for mean and .75 for standard deviation. Consequently, they nearly-often used the direct instruction strategies (mean=3.75, SD= .90) and rarely implemented the IbL (mean=2.12, SD=.78). These findings mean that the IbL had minimally been implemented in chemistry teaching in secondary schools, while the teacher-centered learning approaches were maximally implemented in their instructions.

**Table 1.** *Chemistry teaching and the implementation of the IbL*

| Chemistry Teaching and the Use of the IbL | The teachers' Responses with Frequencies | | |
|---|---|---|---|
| Q1.1 What strategies do you regularly use for chemistry teaching? | Lecturing (99), Drills/exercise (41), Discussion-based learning (22), Conventional experiment (20), Demonstration (10), IT-assisted learning (8), and Inquiry-based learning (5). | | |
| Five-level items | Mean | SD | Interpretation |
| Q1.2 How do you indicate your regular approach in conditioning your students to learn chemistry? (From provide contents to freedom to investigate concepts/ideas) | 2.14 | .75 | Tend to Provide content |
| Q1.3 How often do you use direct instruction in chemistry teaching in a month? (From never to very often) | 3.75 | .90 | Nearly-Often |
| Q1.4, Q1.5, and Q1.6 were invalid and removed | NA | NA | NA |
| Q1.7 How often do you use the IbL in chemistry teaching in a month? (From never to very often) | 2.12 | .78 | Rare |
| Total | 2.67 | .81 | Broadly Low |

The fact that the IbL had minimally been implemented in chemistry teaching practices is not surprising. This result is similar to that of Effendi-Hasibuan et.al.'s (2019) study. Previous studies have also identified that student-centered learning strategies (i.e., IbL) are not adopted maximally in science teaching in Indonesia. Instead, teachers mostly prefer teacher-centered strategies (Mahady, Wardani, Irianto, Somerset, & Nielson, 1996; Thair & Treagust (1999, 2003). Excluding inquiry in teaching, however, is truthfully prevalent in Indonesia. Also, excluding the IbL is common and valid for social subject. For instance; Ekawati (2016), who investigated English teachers' use of the inquiry-based approaches suggested by the curriculum, found that its use was low. The teachers dominantly used direct and cooperation-based instructions in teaching English. The results of Ekawati (2016) and the current study were similar to each other in case the implementation of the IbL is rarely exploited in Indonesia. Therefore, a low adopted extent of the inquiry-based chemistry learning may explain why the Indonesian students' science abilities remain low in regard to the results of the PISA. That is, there are inconsistent issues between the curriculum reforms (2003-2018) and teachers' practical implementations in their chemistry classes.

**b) Pre-existing educational supports for the Implementation of the IbL (Research Question 2)**

As can be seen from Table 2, they had only two adequate educational supports within normal classroom population (mean=3.04, SD=0.95) and the IbL literatures (mean=3.23, SD=0.97). The remaining educational supports were insufficient for time-allocation, facilities, and IbL-competencies of teachers and students. However, their reflective responses showed unsupportive conditions for the use of the IbL (mean=2.77, SD= .15). This minimal educational support may be relevant with the minimal use of the IbL in the city of Jambi.

**Table 2.** *Reflective educational supports for the use of the IbL*

| Available supports for the use of the IbL | Mean | SD | Interpretation |
|---|---|---|---|
| Q2.1 How do you identify time for the use of the IbL? (From very limited to very unlimited) | 2.43 | .74 | Limited time |
| Q2.2 How do you identify learning facilities for the use of the IbL? (From highly incomplete to highly complete) | 2.15 | .67 | Incomplete Facilities |
| Q2.3 How do you identify classroom population for the use of the IbL? (From highly populous to highly sparse) | 3.04 | .95 | Normal classroom |
| Q2.4 How do you identify your knowledge and skills at using the IbL? (From very low to very high) | 2.85 | .57 | Low competency |
| Q2.5 How do you identify your students' skills in using the IbL? (From very low to very high) | 2.93 | .61 | Low competency |
| Q2.6 was invalid and removed | NA | NA | NA |
| Q2.7 How do you identify the IbL literature in your school? (From highly incomplete to highly complete) | 3.23 | .97 | Adequate Literatures |
| Total | 2.77 | .15 | Low Supports |

*The educational support from the learning facilities*

The first low educational support is the facilities available for the teachers to use the IbL. As observed in Table 2, the chemistry teachers reflected incomplete facilities in their schools (mean=2.15 SD= .67). To confirm this finding, their responses to open-ended question (OQ) was used. Their responses included limited materials and equipments such as chemical substances, glasses, balance, cables, etc. Even, some chemistry teachers complained about a lack of laboratory for doing the IbL. Six quotations are presented as follows:

> '…we do not have enough equipment'. (R2)
> 'We [I] do not have enough facilities such as substances, glasses, etc., …'. (R22)
> '…because I do not have a lab [laboratory]'. (R47)
> '…the lack of laboratory'. It [laboratory] is out of service'. (R51)
> 'We [I] need school to support the practical activities…'. (R67)
> 'Inquiry needs complete facilities but we do not have it [facilities]…'. (R90)

Inadequate equipments and facilities for science learning have been a common issue in Indonesia. This finding is in a harmony with previous finding (Effendi-Hasibuan et.al., 2019) showing that 40 out of 70 science teachers referred to inadequate learning facilities for science learning. Some classrooms may be highly challenged to conduct an experiment due to the limitation of basic equipment and chemistry materials. This may stem from limited budget to buy cables and electrical equipment that hence prohibit teachers to conduct experiment activities like the IbL (Coppola, 2008). For this reason, the appropriateness of the IbL may be influenced and criticized from low educational supports for science learning facilities in developing countries (Walberg, 1991). Such limitation may have directed the teachers to dominantly use independent strategies from such scientific facilities as lecturing and lack of the IbL in chemistry teaching.

*The educational support from time*

The second low- educational support is the time limitation. As can be seen from Table 2, the chemistry teachers saw time as a limited use of the IbL (mean=2.43, SD= .74). This not only refers to the limited time for the implementation of the IbL but also prepares their instructional plans and assesses the results for the teachers. Six excerpts are shown in the following:

> '...to be honest I, because of the limited time, had neglected experiments for a long period of time'. (R5)
> '...no time for [conducting] experiment. I am struggling to finish the curriculum [all chemistry contents]'. (R7)
> 'Most of the teachers in my school left experiment behind. No time for it'. (R20)
> 'Using lecturing, I can deliver more [chemistry contents] than using experiment. I need to be quick'. (R32)
> 'I am in a hurry to fulfill my duty. No time for it [IbL]'. (R46)
> 'We have limited time. I cannot do anything with this. It takes a long time to do experiments'. (R68)

This means that insufficient time is very common for the use of the IbL in Indonesia. This finding is in parallel with previous study (Effendi-Hasibuan, et.al., 2019) showing that 55 out of 70 science teachers had limited time to conduct the IbL. Indeed, some classrooms are unable to complete an experiment in chemistry due to the time limitation since chemistry classes regularly take 90 minutes.

In the Indonesian context, the time limitation may come from the complexity of curriculum that contains many subjects (Hadi, 2002). Students have to learn around 14-17 subjects per semester during the compulsory three years at secondary schools. Such a complex curriculum has been designed to equip the Indonesian students with a sound understanding of science, social-science, culture and national diversity, and religions. Unarguably, teachers find it difficult to deliver all curricular content during the semester. To complete an overloaded curriculum may put teachers in an under-pressure situation about adopting inquiry-based learning in practicum (Minner et al., 2010; Staer, Goodrum, & Hackling, 1998). This time limitation may have driven the teachers to disregard the IbL in the city of Jambi.

*The educational support from the teachers' knowledge, skills, and experiences in using the IbL*

As can be seen from Table 2, the chemistry teachers reflected their low competencies in using the IbL (mean=2.85, SD= .57). This finding is similar to Effendi-Hasibuan et.al.'s (2019) study indicating that 35 out of 70 science teachers lacked knowledge, skills, and experiences of the using the IbL. Also, some of them expressed their anecdotal understanding about inquiry in the open-ended question (OQ). Nine quotations are shown in the following:

> '...to invite students to do investigation…' (R9)
> 'I know inquiry is used to produce concepts…' (R11)
> 'Inquiry is …to find solutions' (R12)
> '…to make my students to be more active' (R27)
> 'Students find something important in the experiment...' (R33)

'To nurture students' creativity…' (R36)
'Challenging students to produce concepts…'(R39)
'Encouraging students to make conclusions in inquiry…'(R55)

The chemistry teachers held only the segmented portions of the definition of the IbL and simply understood the IbL as an activity to investigate something, find/generate concepts, make conclusion, find solution, make students more active and creative. Also, they comprehended the IbL as an activity to prove pre-existing concepts. These incomplete understanding of the IbL demonstrated minimal compliance with the definition of the IbL written in related literature. Previous studies defined the IbL as a learning activity to nurture students' senses of scientific investigation and to develop their scientific knowledge and procedural skills (Baker & Leyva, 2003; NRC, 1996). Self-generated scientific problems engage students in answering them (Fay & Bretz, 2008; NRC, 2000). Teachers are recommended to use appropriate questions (Alessandrini & Larson, 2002; Colburn, 2000; Oliveira, 2010; Windschitl, 2002) and scaffolds/clues (Davis, 2003; Edwards & Mercer, 1987; Hmelo-Silver, et al., 2007) by guiding students to collect data, interpret findings, and formulate conclusions. The minimal overlap between the chemistry teachers' anecdotal understanding of the IbL and the related literature represented their insufficient competencies of the use of the IbL. This limited competence may have hampered them to perform the IbL in their teaching practices.

*The educational support from the students' skill in performing practical activities*

As observed in Table 2, the chemistry teachers reflected their students' inadequate competencies in conducting practical activities (mean=2.93, SD= .61). Some of them depicted that their students were not ready to find "something" due to low knowledge, skills, and experiences to perform an inquiry experiment. Because the students were unable to do the IbL experiment, analyze and conclude their results, the IbL was unsuitable for their students. Eight excerpts are presented as follows:

'…they had low ability to do this [the inquiry experiment]'(R6)
'…this [inquiry] is not applicable for my students here' (R10)
'…the students were not ready…in inquiry they must find [data and conclusion] by themselves' (R15)
'Inquiry experiment is not feasible for my students as they have low experience in using it'(R25)
'…It [doing inquiry] is easy to say but difficult to do, particularly with my students' (R31)
'…they [students] are unable to analyze and conclude' (R37)
'…they have low skills in doing experiment' (R40)
'I do not know if they [the students] can do it [inquiry]' (R50)

The teachers' reflections of their students' inadequate competencies in performing practical activities (i.e., IbL) are unsurprising. Despite the fact that few Indonesian students participate and gain the respected achievements in several science competitions such as the Physics competition, etc., majority of the Indonesian students hold inadequate competencies in science. This may be seen as a "iceberg phenomenon", whose major parts are under "the sea-surface". The former may have supportive learning environments (i.e., schools, teachers, parents, facilities, fund) but the latter may have the different ones.

The students' weak competencies at conducting inquiry might not be solely their flaws. This may stem from the teachers' views neglecting to engage their students in the IbL experiment. It is assumed that the students' weaknesses may have a reciprocal relation with the teachers' failure to implement the IbL. This means that the less the teachers engage the students in the IbL activity the lower the students are exposed to and familiar with the IbL. Despite intellectually differences in students; the regular students would normally be able to perform the IbL experiment if they are routinely invited to use their skills. Hofstein, et al. (2005) addressed that engaging high school chemistry students in an inquiry-type practical activity would improve students' abilities in conducting inquiry and increase the ability in generating questions as compared with traditional chemistry learning/practical activity. This means that the students' poor capabilities may have not fit for the use of the IbL. But, this may also result from the poor chemistry teaching practices excluding the IbL in the city of Jambi.

*The educational support from classroom population*

As can be seen from Table 2, the chemistry teachers had normal classrooms with reasonable students (mean=3.04, SD= .95). That is, the teachers tended to perceive the classroom population in the city of Jambi as an ideal for the IbL. This may come from a national regulation released in 2018. Namely, each classroom has to contain maximally 36 students. However, having 36 students a classroom may not be ideal for the IbL in that the teachers can guide approximately nine groups of four students. That is, nearly four students a group is ideal for a practical activity. This might provide a great pressure for the teachers to accomplish their lessons. The current study suggests to ideally have 20-25 students within 5-6 groups to guide them (Habibi, Mukminin, Sofwan, & Sulistiyo, 2017). Thereby, such a process may reduce their stress levels and tensions during the lesson.

The teachers' reflections concerning the updated classroom size did not represent earlier traditional classroom-population. Before 2018, a classroom, which contained up to 45 students a classroom, was very crowded and unfeasible for the IbL. Five quotations including the IbL in their regular chemistry teaching practices (see Table 1) are displayed in the following:

> 'I found it difficult to use the IbL before as I had many students...'(R3)
> '…due to the number of students that was very large. It was difficult to guide them [in inquiry]' (R17)
> 'It was hard for me to order them as there were 39 students in the classroom before'…'(R29)
> 'It produced big noise as the classroom was very crowded before…' (R81)
> '…the students [number] were very large and challenged me…'. (R95)

The number of students occupying a classroom in Indonesia was large and included about 30-45 students a classroom. Given this issue, an enormous practical challenge appeared for the teachers to implement the IbL. This situation may have reduced the teachers' intentions to conduct the IbL because of the clamor, uproar and disorder conditions. Undoubtedly, the teachers may have preferred employing a teacher-centered instruction such as lecturing for their overcrowded classrooms (Thair & Treagust, 1999; van den Berg & Lunetta, 1984).

*The educational support from the related literature and references*

Finally, the chemistry teachers had adequate references about the IbL in their schools (mean=3.23, SD= .97). They may have learned them from multiple resources such as books, articles, internets, etc. This means that the IbL references are not a shortfall of the use of the IbL in the city of Jambi.

**c) Situational Beliefs on the use of the IbL (Research Question 3)**

As seen from Table 3, all of the teachers believed that their learning situations were ill-structured for inquiry (mean=1.67, SD= .53). They did not believe that the IbL could be successfully implemented under limited time (mean=1.40, SD= .57) and facilities (mean=1.38, SD= .58). Further, they did not believe that inquiry was viable in a crowded classroom (mean=1.60, SD= .60) and with their and the students' low capabilities (mean=1.95, SD= .60, and mean=1.88, SD= .52). These negative beliefs are parallel with the low available-educational supports for the use of inquiry as discussed before. These beliefs seemingly reflected their consistent attitudes in looking at the learning situations. Consequently, they were unsure that they and their students would enjoy using the IbL under such conditions (mean=1.67, SD= .70, and mean=1.53, SD= .61). They also disliked their roles to be facilitators (mean=1.72, SD= .58) because they disbelieved that their students needed inquiry to learn chemistry (mean=1.61, SD= .61). Finally, they suspected that the overloaded curriculum was fit for the implementation of the IbL (mean=1.97, SD= .48).

**Table 3.** *Teachers' beliefs of the implementation of the IbL*

| Teachers' beliefs of the IbL (1=strongly disagree, 2= disagree, 3= agree, 4=strongly agree) | Mean | SD | Interpretation |
|---|---|---|---|
| Q3.1. The IbL can be implemented under pre-existing time | 1.40 | .57 | Broadly disagree |
| Q3.2. The IbL can be implemented using pre-existing facilities | 1.38 | .58 | |
| Q3.3. The IbL can be implemented with my crowded classroom | 1.60 | .60 | |
| Q3.4. Given my current knowledge and skills, I can do the IbL | 1.95 | .60 | |
| Q3.5. The IbL can be implemented by my regular students. | 1.88 | .52 | |
| Q3.6. The IbL provides enjoyment for me | 1.67 | .70 | |
| Q3.7 The IbL provides enjoyment for my students | 1.53 | .61 | |
| Q3.8. The IbL is viable for the Indonesian curriculum | 1.97 | .48 | |
| Q3.9. My students need the IbL to learn chemistry | 1.61 | .61 | |
| Q3.10. I prefer helping/facilitating students' learning to telling them content | 1.72 | .58 | |
| Total | 1.67 | .53 | |

The teachers' unsupportive situational beliefs of the use of the IbL are not merely evidenced in Indonesia. Previous study has identified that teachers' beliefs retain their traditional teaching practices in Fiji (Cook & Taylor, 1994). Science teachers often see that this strategy will only work well with capable students (Colburn, 2000). Teachers, who believe that their students have the capacity to perform the inquiry-based activities, will tend to include these activities in their teaching practices in order to achieve the goals of the curriculum (Wallace & Kang, 2004). On the other hand, Cronin-Jones (1991) elicited that teachers did not use the inquiry-based activities since they believed that their students needed explicit directions, and would be better taught by repeated drills and exercises.

Teachers' unsupportive beliefs of science teaching/learning also affect their views of the curriculum, instructional activities, and teacher roles (Brickhouse, 1990; Brickhouse & Bodner, 1992; Pajares, 1992). Many teachers see science as a body of knowledge (Brickhouse, 1990; Duschl & Wright, 1989; Gallagher, 1991) containing facts, principles and concepts (Tobin & Mc Robbie, 1996). As a result, many teachers view their roles in science-teaching as a curriculum-content transmitter (Tobin & Mc Robbie, 1996) rather than as a facilitator. They believe that the most important outcome for the students is to successfully negotiate examinations and well-prepared for the next educational level (Colburn, 2000). Problem solving skills are nurtured by repeated drills and exercises since these teaching-strategies are believed to be the best way to equip students with facing the examinations (Cronin-Jones, 1991). Thereby, they enjoy these practices. From this point of view, the unsupportive beliefs of the learning situations might have influenced the teachers' decisions of the use of the inquiry-based chemistry learning/practices in the city of Jambi.

**d) Relations amongst the dimensions (Research Question 4)**

The findings of this study indicated that the educational supports and beliefs were at the same direction with the inquiry implementation in the city of Jambi. These three dimensions were seemingly related to one another. To emphasize this relation, the question 'Is there any relationship amongst educational supports, situational beliefs, and the adoption of the IbL?' was asked. Their responses to this question were employed to a multiple regression analysis. As seen from Table 4, these three dimensions had significantly interrelationships ($p< .05$) with adequate coefficient of Pearson. The inquiry adoption significantly correlated with the educational supports ($r = .56^{**}$) and beliefs ($r = .57^{**}$), while the educational supports did significantly with the beliefs ($r = .68^{**}$). These results indicate that the lower/greater the educational supports are available the lower/greater the teachers' beliefs possess on the learning situations. Hence, the IbL is feasible to do depends on the educational supports and the situational beliefs.

**Table 4.** *The contribution(s) of the educational supports and situational beliefs to the IbL*

| Inter- correlations between dimension | | a | b | c | Standardized Beta Coefficients [a] | R Square | ANOVA [a] |
|---|---|---|---|---|---|---|---|
| a | Pearson Corr | 1 | | | | | |
| | Sig. (2-tailed) | | | | | | |
| | N | 99 | | | | | |
| b | Pearson Corr | $.56^{**}$ | 1 | | β= .32 | | |
| | Sig. (2-tailed) | .000 | | | p-value<.05 | $R^2$= .382 | p-value =.000[b,c] |
| | N | 99 | 99 | | | | |
| c | Pearson Corr | $.57^{**}$ | $.68^{**}$ | 1 | β= .35 | | |
| | Sig. (2-tailed) | .000 | .000 | | p-value<.05 | | |
| | N | 99 | 99 | 99 | | | |

**. Correlation is significant at the 0.01 level (2-tailed).(a. IbL adoption, b. supports, c. teachers' beliefs)

The fact that the significant correlations amongst these three dimensions are reasonable may come from the straight forward responses of the teachers for the learning conditions. The teachers, who had submerged in the unsupportive learning situations (i.e., is the city of Jambi), unhesitantly expressed their firm views. That is, they depicted that poor educational supports were ill-fit for the use of the inquiry learning. What they perceived about the educational supports was clearly reflected in their beliefs and then manifested in their classroom actions. This suggests that the teachers under investigation tend to report their natural thoughts, attitudes, and behaviors (with no bias and ambiguity) of this issue addressing that the IbL under those conditions is not viable in the city of Jambi. So, they may ignore it even though the curriculum offers its use in the science/chemistry teaching.

As observed in Table 4, the educational supports and teachers’ beliefs had a significant simultaneous effect (ANOVA $p< .05$) with 38.2% contribution ($R^2$=.382) to the adoption of the IbL. These also had significant direct effects ($p<.05$) to the implementation of the IbL with similar magnitudes ($\beta$= .32 and $\beta$= .35). This means that the educational supports and situational beliefs share similar contributions to the teachers’ use or neglection of the IbL while implementing their teaching activities (see Figure 1). At this point, the minimal implementation of the IbL- besides by other unobserved constraints- may stem from the low educational supports and teachers' beliefs of their learning situations in the city of Jambi. This finding advocates Nespor (1987), Pajares (1992), and Wallace and Kang’s (2004) views stating that teachers’ beliefs of the learning situations are powerful in influencing their decision making processes of classroom. In addition, this finding has enriched the reservoir of evidence on the educational supports and teachers' beliefs of the learning situations (situational beliefs) that affect science teachers’ adoption or neglection level of the IbL in science teaching.

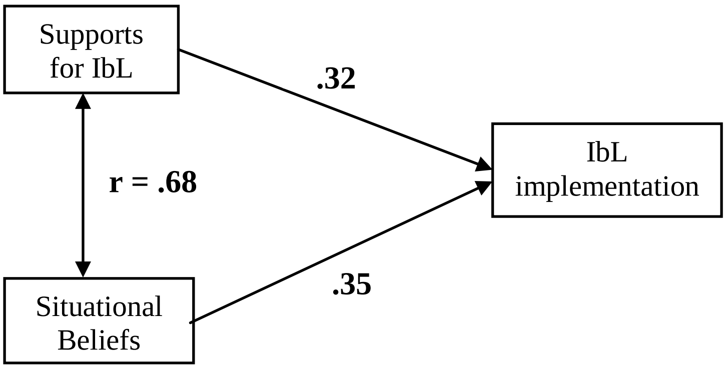


***Figure 1.*** Direct effects of the educational supports and beliefs on the implementation of the IbL

## CONCLUSIONS and FUTURE RESEARCH

This study designed and used a 21-item valid and reliable questionnaire looking for the adoption of the inquiry-based chemistry learning (IbL) recommended by the Indonesian science curriculum. Also, it examined the underlying factors influencing the implementation of the IbL and the relationships amongst these factors and the adoption of the IbL.This study showed that the chemistry teachers minimally implemented the IbL in the city of Jambi even though the curriculum has recommended its use. They were predominantly apt to use more traditional teaching strategies such as lecturing while teaching chemistry. Unsupportive learning conditions and situational beliefs, however, emerged as the key factors of the minimal adoption. Namely, six educational supports and ten beliefs showed significant contributions to the low adoption of the IbL in chemistry/science teaching.

The findings will potentially contribute to the sort of evidence concerning the implementation of the IbL. Future studies should focus on any difference between teachers’ inquiry practices in terms of cities, suburbs, and rural areas. Likewise, differences between various science teachers (e.g., Physics, Biology, and Mathematics) should also be considered. Further studies, thus, ought to look at the implementation of the IbL under diverse circumstances as well as testing necessary adaptive strategies for in-service teacher education and overcoming their interfered-constraints (Anderson, 2002; Furtak 2006; Hmelo-Silver et al., 2007; Zohar, Degani, & Vaaknin, 2001).

This study, therefore, provides insights for the Indonesian educational authorities to take any possible action/solution. For example; this may involve the provision of rational time, manageable classroom population, adequate scientific facilities, appropriate workshops and trainings, and any other possible educational supports that facilitate teachers' adoption and implementation of this strategy. Jonathan (1998) argues that ignoring the fitness of educational supports and teachers' beliefs will only bring a limited success for the initiative of the curriculum reformation. Because this study provides important information for teachers about other constraint-infested areas, they may take them into account by using the inquiry-based learning in their science teaching practices. Finally, since the limited educational supports and ill-fit situational beliefs affected the minimal adoption of the inquiry-based chemistry/science learning in Indonesia, further studies are supposed to investigate the extent to which the inquiry-based chemistry/science learning contribute to the Indonesian students' science competences in the PISA results.

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