Inquiry-Based Learning: Student Teachers' Challenges and Perceptions

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Inquiry-based learning (IBL) is a student-centered approach driven by students' questions and their innate curiosity. IBL was introduced and effectively implemented in the general secondary teaching methods course at the American University in Dubai. The study made use of a mixed methods approach. It was guided by two research questions: 1). What factors hinder the implementation of IBL in the student teachers' classrooms? 2). Why do student teachers favor the use of IBL in their classroom? Eight student teachers enrolled in the general secondary teaching methodology course at the American University in Dubai (Fall 2017) participated in the study. First, they completed a survey to gain insight into the challenges and difficulties student teachers face in the implementation of IBL in their classroom. In order to build on the results from the quantitative phase, the student teachers were next involved in a qualitative data collection phase, where they had to answer the question: What makes you want to implement IBL in your own classroom? Results revealed that student teachers considered 'school system' as a factor that hinders the implementation of IBL in their classroom. In addition, data collected from the open-ended question were categorized into two main themes: IBL creates a culture of deep and transferable learning and strengthens student engagement and IBL allows for differentiation and empowers student voice and choice. To make the most of this innovative student-centered approach, IBL needs to be highly valued at all academic levels starting from early stages and across all disciplines. It is essential that IBL becomes embedded in daily school curricula to ensure an interactive learning journey that calls out for student questioning, deep learning, and engaged, motivated learners.

Introduction

Let us consider the phrase, 'students' role' and reflect on its implications. To do so, we imagine ourselves visiting a classroom in the school we are currently teaching at. What do we observe? What do we notice? How are students reaching understanding? Are teachers predominantly lecturing to cover content? Are students consistently active as learners? Are they engaged in investigations that promote higher order thinking skills and conceptual understanding? Are students involved in a collaborative learning journey and offered a chance to explore their interests, opinions, feelings, beliefs, and curiosities? Such questions reveal a lot about the classroom culture. Today, it is essential that we revisit our classroom culture, reflect on what we think about our 21st century students, and ask ourselves how students want to learn. Our

students today want to acquire new knowledge by doing. They want to think, analyse, evaluate, apply, and create. They want to tell a story, be autonomous, interact, and collaborate. They want to explore and be engaged while using meaningful technological tools.

Our societal needs have tremendously changed over the years. We need to think of our students and the challenges that are ahead of them. To make sure our students are well equipped with the necessary tools to face the demands and expectations of the future, there has been a clear need for instructional practices that promote critical thinking, reflection, questioning, collaboration, communication, and research. Inquiry-based learning (IBL) is a student-centered instructional approach that makes use of meaningful tasks such as cases, projects, and research to situate learning (Avsec & Kocijancic, 2016). Students are expected to work collaboratively to identify how to solve a problem, gain research skills, and trade-off capacity (Avsec, Rihtarisic, & Kocijancic, 2014). With IBL, students are engaged in the learning process and are making sense of the world around them. Alfieri et al. (2011) refer to the benefits of IBL in the classroom by explaining that, "allowing students to interact with materials, models, manipulate variables, explore phenomena, and attempt to apply principles affords them with opportunities to notice patterns, discover their underlying causalities, and learn in ways that are seemingly more robust" (p. 3). Therefore, adopting IBL engages students in the learning process and maximizes learning. The purpose of the following study was to gain insight into the challenges student teachers face in the implementation of IBL in their classrooms. It also aimed at studying student teachers' reflections, views, and opinions on IBL. Hence, the study focused on the following two research questions:

1. What factors hinder the implementation of inquiry-based learning in student teachers' classrooms?
2. Why do student teachers favor the use of inquiry-based learning in their classroom?

Inquiry-based Learning: Definitions and Theoretical Background

Inquiry is a term used both in education and in daily life to refer to seeking explanations or information by posing questions (Harlem, 2013). IBL is an instructional practice where students are at the center of the learning experience and take ownership of their own learning by posing, investigating, and answering questions (Caswell & LaBrie, 2017). It is also considered a form of self-directed learning where students take responsibility for their learning (Spronken-

Smith & Walker, 2010). Bell, Smetana, and Binns (2005) use the phrase, 'active learning process', to refer to the nature of inquiry where students are expected to answer a research question using data analysis and information exchange. IBL is seen as a system of learning that supports the development of students' problem solving and critical skills (Maxwell, Lambeth, & Cox, 2015). Saunders-Stewart, Gyles, and Shore (2012) consider the many forms of IBL and mention that it includes analysis, problem solving, discovery, and creative thinking. Although inquiry is student oriented, Zangori, Forbes, and Biggers (2012) argue that teachers may direct students at times during the learning process, as some beginner students may need more instruction to hone their inquiry skills. Guido (2017) examines inquiry from both a student and a teacher's point of view. He explains that from a student's perspective, IBL focuses on investigating an open question or problem, while from a teacher's perspective, inquiry-based teaching focuses on moving students beyond basic curiosity into the realms of critical thinking and understanding.

IBL is rooted in constructivism, which is a learning theory, and states that humans construct their own knowledge and meaning from their personal experiences (Tamim & Grant, 2013). Therefore, in such a case, knowledge is being built rather than delivered by the teacher. John Dewey, a constructivist and an advocate of IBL, states that students should actively be in engaged in the learning process. He explains: "if you have doubts about how learning happens, engage in sustained inquiry: study, ponder, consider alternative possibilities, and arrive at your belief grounded in evidence" (Dewey, 1998, as cited in Mapes, 2009, p.11). John Dewey strongly believed that students need to be reflective problem solvers (Santrock, 2017). Jerome Bruner contributes to constructivism and is primarily concerned with making education more relevant to student needs at each stage, and he believes that teachers could accomplish this by allowing students to actively participate in the learning process (Roblyer & Doering, 2013). His theory, discovery learning, is a form of IBL and states that students are more likely to understand and remember concepts that they discover during their interaction with the environment (Roblyer & Doering, 2013). Lev Vygotsky known for his social constructivism theory explains that social interaction and critical thinking are two main ingredients of a learning process (Liu & Chen, 2010). He describes IBL as an "integral part of creating …. a social constructivist classroom" (Powell & Kalina, 2009, p. 244).

IBL can be implemented at different levels (Duran & Dökme, 2016). Mackenzie (2016) explores the differences between four types of student inquiry – structured, controlled, guided, and free. He further explains that teachers usually begin the year in a structured inquiry model, move to controlled inquiry, then guided inquiry, and if all goes well, conclude the year with free inquiry. The following is a brief summary of Mackenzie's four types of student inquiry:

- Structured Inquiry: Students follow the lead of the teacher as the entire class engages on one inquiry together
- Controlled Inquiry: the teacher chooses topics and identifies the resources students will use to answer the questions
- Guided Inquiry: the teacher chooses topics and questions, and students design the product or solution
- Free Inquiry: the students choose their topics without reference to any prescribed outcome

Marshall (2013) has previously explored the continuum of inquiry and has asked his readers to imagine on one end the teacher as the teller of information, and on the opposite end, open inquiry. He has referred to the following terms to describe the four types of inquiry: teacher as a teller, prescriptive inquiry, guided inquiry, and open inquiry. He contends that students engaged in prescriptive inquiry are usually doing little to no critical thinking and that is the reason why it should be the exception rather than the general procedure. Whereas, "when instruction includes effective guided inquiry, learning is rich, and challenging to students of all ability levels" (Marshall, 2013, p.17).

Benefits of Inquiry-Based Learning

In a video titled, 7 Skills Students Need for Their Future (2009), Dr. Tony Wagner delivers a speech where he identifies a variety of skills needed for student success in a global economy. The seven skills are: critical thinking, problem solving, collaboration and leading with influence, agility and adaptability, initiative and entrepreneurialism, effective oral and written communication, accessing and analyzing information and curiosity and imagination. Marks (2013) explains that: "In an IBL classroom, students learn, practice, and reflect on these seven skills in an authentic process that imitates those processes used in the real world" (p. 23).

IBL is an instructional strategy that brings teaching and learning into alignment with the student and the skills needed for future success (Marks, 2013). Many studies have been conducted on the benefits of applying IBL in the classroom. Guido (2017) identifies seven benefits of IBL, arguing that it: (a) reinforces curriculum content, 2). warms up the brain for learning, 3). promotes a deeper understanding of the content, 4). helps make learning rewarding, 5). builds initiative and self- direction, 6). works in almost any classroom, and 7). offers differentiated instruction.

According to Sockalingam, Rotgans, and Schmidt (2011), when students are provided the opportunity to work on a problem, they gain new knowledge and further extend and deepen their current understanding. When students explore and investigate, they take responsibility for their learning, as they are expected to make decisions and reach conclusions and judgments (Jonassen, 2000). Similarly, Hwang and Chang (2011) argue that when students learn by means of discovery and investigation in authentic settings, they improve their critical thinking skills. Goldston et al. (2010) argue that IBL considers the knowledge aspect of learning, yet places great emphasis on critical thinking, problem solving, and communication abilities. A research study by Gu et al. (2015) has found that students involved in inquiry-based practices have reported higher levels of academic self-efficacy, resolved conflicts at a higher rate, been less afraid to take risks, and more likely to continue trying different ways to be successful when they failed. Marks (2013) concludes that students who are actively engaged in inquiry do not only master content but master habits of mind. Harlen (2013) mentions that developing understanding through students' own thinking and reasoning has many benefits for students including: enjoyment and satisfaction in finding out for themselves something that they want to know, seeing for themselves what works rather than just being told, satisfying and at the same time stimulating curiosity about the world around them, and developing progressively more powerful ideas about the world around them.

Framework for Inquiry-Based Learning

The variety of inquiry phases and cycles is well documented in the educational literature (Pedaste et al., 2015). For example, Marshall (2013) lists four inquiry phases: Engage, Explore, Explain, and Extend and explicitly incorporates formative assessment (continually checking in with students) and reflective practice (now where?) into each phase. Whereas Bybee et al. (2006), list five inquiry phases: Engagement, Exploration, Explanation, Elaboration, and

Evaluation. The way an inquiry cycle is presented usually suggests an ordered sequence of stages. However, researchers explain that IBL is not a prescribed, uniform linear process (Pedaste et al., 2015). Peter and Stout (2011) adapt the 6E Model to inquiry, which is similar to the 5E Instructional Model by Bybee et al. (2006), but includes an additional component: E-learning. A summary of the 6E Instructional Model is provided in the table below (Peters & Stout, pp. 10-11):

Table 1. 6

E Instructional Model

Component	Characteristics
Engagement	The teacher or a curriculum task accesses the learners' prior knowledge and helps them become engaged in a new concept through the use of short activities that promote curiosity and elicit prior knowledge.
Exploration	Exploration experiences provide students with a common base of activities within which current concepts (i.e., misconceptions), processes, and skills are identified and conceptual change is facilitated.
Explanation	The explanation phase focuses students' attention on a particular aspect of their engagement and exploration experiences and provides opportunities to demonstrate their conceptual understanding, process skills, or behaviors.
Elaboration	Teachers challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills. Students apply their understanding of the concept by conducting additional activities.
Evaluation	The evaluation phase encourages students to assess their understanding and abilities and provides opportunities for teachers to evaluate student progress toward achieving the educational objectives.
E-Learning	This phase is infused throughout the model to enhance the technological skills of the learners while they do things such as gather information, engage in explorations, explain and communicate their findings.

The inquiry models provide a meaningful, coherent structure to help teachers plan, implement, and assess their instruction (Marshall, 2013).

Methodology

In order to uncover the challenges student teachers face in the implementation of IBL in their classrooms, explore their beliefs and opinions regarding IBL, and examine their personal reflections on the reasons they favor the use of IBL in the classroom, a mixed method design was implemented to gather and analyze data.

Participants

IBL was thoroughly introduced in the general secondary methodology course offered at the Graduate School of Education at the American University in Dubai. Seven female student teachers and one male student teacher enrolled in the methodology course participated in the following study. Two student teachers were teaching Science. Two were teaching French as a second language. Two were teaching Math, and one of them was also Head of the Math Department. Two were not teaching at the time. A profile of the student teachers is presented in

Table 1

Student Teacher Profiles

CHARACTERISTICS	STUDENT TEACHERS
Course Size	8
Gender	
Male	1
Female	7
Discipline	
Science	2
French as second language	2
Math	2
Not Teaching	2

Design and Procedure

The first method focused on surveys. According to Ary et al. (2013) survey research makes use of instruments such as questionnaires and interviews to collect data from groups of individuals. It also permits the researcher to summarize the characteristics of different groups or to measure their attitudes and opinions towards an issue.

IBL was implemented in the general secondary methodology course at the American University in Dubai for two main purposes. The first purpose was to ensure a student centered learning

culture that embraced the following essential factors: questioning, research, collaboration, reflection, and higher order thinking. Every single session of the course included hands-on activities that began by exploring what student teachers already knew about the subject. The course was not a reflection of a traditional classroom where the teacher would bestow the students with the knowledge, but rather, they would construct that knowledge together through exploring gallery walks, inquiring into in a variety of visual thinking routines, taking part in discussion and collaborative tasks, watching videos, engaging in reflection, formulating essential questions, finding the answers to their questions, and sharing their learnings. Teacher-talk was at a complete bare minimum and included clarifying, guiding, supporting, and extending the learning process. Student teacher would reflect at what they had done and realize they needed only minimal help to come up with the content themselves. IBL was also implemented in the general secondary methodology course to make sure student teachers received hands-on experience in IBL and implement it successfully and meaningfully in their own classrooms.

The student teachers completed an online survey, which was previously designed by researchers working on the Mascil project (Project Evaluation, 2013) that aimed to promote widespread use of IBL in mathematics and science education. The two student teachers who were not teaching at the time did not complete the online survey.

The survey addressed teachers' challenges, views, and beliefs on IBL. For the purposes of the following study, only one domain was considered: 'Problems with Implementation'. This domain included fifteen indicators that could be grouped into four main factors: student readiness and attitude, classroom management, resources, and school system.
Student teachers were asked to think of each indicator and rate the extent to which they agreed. Each student teacher received an electronic copy of the forces and indicators and a brief short introductory paragraph which included an overview of the study and an assurance of confidentiality. The items did not allow participants to opt for a neutral response, therefore, they were asked to use a Likert scale from 1 to 4 to respond to each force and indicator. A score of '1' indicated 'strongly disagree', '2' indicated 'disagree', '3' indicated 'agree', and '4' indicated 'strongly agree'.

In order to build on the results from the quantitative phase and provide space for freedom and spontaneity, the student teachers were next involved in a qualitative data collection phase.

Student teachers were asked to answer the open-ended question: What makes you want to implement IBL in your classroom?

Findings

In order to gain insight into the aspects that hinder the implementation of IBL in the student teachers' classrooms, they were asked to rate fifteen indicators related to four different factors: student readiness and attitude, classroom management, resources, and school system. The first factor, 'Student Readiness and Attitude' included four indicators. The first indicator evaluated by the student teachers was, 'Students don't like IBL.' The mean score was 1.83 on a 4-point scale, indicating that the student teachers almost disagreed. The second indicator evaluated by the student teachers was, 'Students are not able to do inquiry.' The mean score was 2.33 on a 4-point scale, indicating that the student teachers disagreed. The third indicator evaluated by the student teachers was, 'I worry about my students getting lost and frustrated in their learning in IBL lessons.' The mean score was 2.16 on a 4-point scale, indicating that the student teachers disagreed. The fourth indicator evaluated by the student teachers was, 'IBL is too difficult for many students.' The mean score was 2.66 on a 4-point scale, indicating that the student teachers disagreed. The mean score for the overall factor, 'Student Readiness and Attitude" was 2.24 indicating that student teachers disagreed that students readiness and attitude hindered the implementation of IBL. Table 1 presents the mean scores of the first factor, 'Student Readiness and Attitude'.

Table 1

'Factor1: Student Readiness and Attitude' Mean Scores'

Standard	Mean Score
Indicator 1	1.83
Indicator 2	2.33
Indicator 3	2.16
Indicator 4	2.66
Total	2.24

The second factor, 'Classroom Management' included three indicators. The first indicator evaluated by the student teachers was, 'I worry about student discipline being more disruptive in IBL lessons.' The mean score was 2.16 on a 4-point scale, indicating that the student teachers

disagreed. The second indicator evaluated by the student teachers was, 'I don't feel confident with IBL.' The mean score was 1.66 on a 4-point scale, indicating that the student teachers strongly disagreed. The third indicator evaluated by the student teachers was, 'I think group work is difficult to manage.' The mean score was 2 on a 4-point scale, indicating that the student teachers disagreed. The mean score for the overall factor, 'Classroom Management" was 1.94 indicating that student teachers disagreed that classroom management hindered the implementation of IBL. Table 2 presents the mean scores of the second factor, 'Classroom Management'.

Table 2

'Factor2: Classroom Management' Mean Scores

Standard	Mean Score
Indicator 1	2.16
Indicator 2	1.66
Indicator 3	2
Total	1.94

The third factor, 'Resources' included four indicators. The first indicator evaluated by the student teachers was, 'I don't have enough adequate teaching materials.' The mean score was 1.83 on a 4-point scale, indicating that the student teachers almost disagreed. The second indicator evaluated by the student teachers was, 'IBL is not included in the textbooks I use.' The mean score was 2.33 on a 4-point scale, indicating that the student teachers disagreed. The third indicator evaluated by the student teachers was, 'The quality of available instructional materials.' The mean score was 2.33 on a 4-point scale, indicating that the student teachers disagreed. The forth indicator evaluated by the student teachers was, 'I don't have sufficient technology resources.' The mean score was 2.83 on a 4-point scale, indicating that the student teachers almost agreed. The mean score for the overall factor, 'Resources" was 2.33 indicating that student teachers disagreed that quality and availability of resources hindered the implementation of IBL. Table 3 presents the mean scores of the first factor, 'Resources'.

Table 3

'Factor3: Resources' Mean Scores

Standard	Mean Score
Indicator 1	1.83
Indicator 2	2.33
Indicator 3	2.33
Indicator 4	2.83
Total	2.33

The fourth factor, 'School System' included five indicators. The first indicator evaluated by the student teachers was, 'The curriculum does not encourage IBL.' The mean score was 2.16 on a 4-point scale, indicating that the student teachers disagreed. The second indicator evaluated by the student teachers was, 'There is not enough time in the curriculum.' The mean score was 2.83 on a 4-point scale, indicating that the student teachers nearly agreed. The third indicator evaluated by the student teachers was, 'My students have to take assessments that don't reward IBL.' The mean score was 3 on a 4-point scale, indicating that the student teachers agreed. The forth indicator evaluated by the student teachers was, 'Too little time is available to plan and prepare lessons.' The mean score was 3.16 on a 4-point scale, indicating that the student teachers agreed. The fifth indicator evaluated by the student teachers was, 'The school system does not encourage changes.' The mean score was 2 on a 4-point scale, indicating that the student teachers disagreed. The mean score for the overall factor, 'School System" was 2.63 indicating that student teachers almost agreed that the school system hindered the implementation of IBL. Table 4 presents the mean scores of the first factor, 'School System'.

Table 4

'Factor4: School System' Mean Score's

Standard	Mean Score
Indicator 1	2.16
Indicator 2	2.83
Indicator 3	3
Indicator 4	3.16
Indicator 5	2
Total	2.63

Figure 1 compares the mean scores of the four factors, 'Student Readiness and Attitude', 'Classroom Management', 'Resources', and 'School System'.

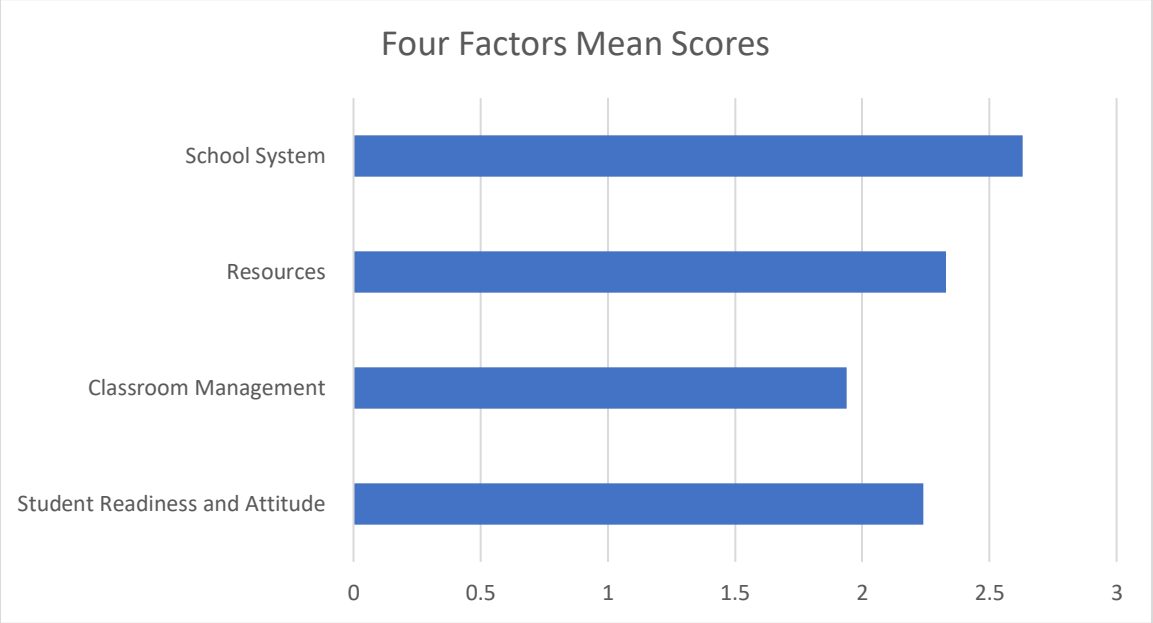

Figure 1. Comparing the Four Factors Mean Scores

Data collected from the open-ended question, 'What makes you want to implement IBL in your own classroom?' were categorized into two themes: IBL creates a culture of deep and transferable learning and strengthens student engagement and IBL allows for differentiation and empowers student voice and choice.

Theme 1: IBL Creates a Culture of Deep and Transferable Learning and Strengthens Student Engagement

IBL is a teaching approach that engages all students in a variety of questions. Such questions have a number of characteristics. First, the questions are open ended, which means they are not limited to one answer. Second, they require higher order thinking skills, as students need to analyze, infer, reflect, and evaluate. Third, the questions call for support and reasoning. Fourth, they often lead to debate, discussions, and the emergence of new questions:" *Students take the time to formulate their own wonder questions… They brainstorm questions that are not restrained… open ended questions….. questions that require them to think about a certain aspect …. They formulate questions and they know that they might have more than one answer….*

Students keep on visiting their questions again and again …. They add new acquired thoughts …. They add new learnings …. They share their learnings with their friends…. They feel content, happy, and confident to share what they discovered…. They are proud to share their thinking…. They reflect on what they learned …. It is rewarding to see how discussions arise when students want to share their findings …. Discussions often lead to debates… It is a cycle and new questions keep on popping up." Fifth, such questions can be student oriented, as students are given the choice to formulate their own questions. When students ask their own questions, their motivation increases, which eventually leads to an increase in the likelihood of investigating and acquiring new knowledge. Providing students with an opportunity to ask questions and engage in the process of finding answers on their own, helps them grasp knowledge at a deeper level: *"They continuously want to ask questions…. They are fascinated by everything around them…. They want to discover and learn about things around them…. Inquiry starts with a question and when students are allowed to think about their own question, they become excited…. They want to find answers to questions they developed…. They are curious about their questions…. When students have the opportunity to ask questions, especially questions that mean something to them, they are invested in the learning process… Questions come from students' own curiosity and this makes the whole difference…. The natural urge to inquire creates such an excitement."*

By following the 6E Model of Inquiry, students will think about *how* they have learned, not just *what* they have learned: *"Students think about the steps they took to arrive to a conclusion…. It is never about the product only…. The process is important…. Students reflect on the tools they made use of to reach their understanding"*. Students will reflect on each phase of the inquiry cycle, move across the different phases, and think about their thinking. As students reach final decisions and conclusions, they tend to defend their own perspectives, listen to other perspectives, and participate in provocative debates and discussions. This ensures a learning process that is deep, enduring, transferable, and profound: *"Active learning is ongoing in an IBL classroom…. Students are working in groups and cooperating together to solve a certain task or find an answer to a question…. They listen to one another and engage in meaningful and rich discussions…. Students are always on the go….. They are analyzing, thinking, comparing, reflecting, and discussing…. It is refreshing to see the thinking in the classroom…. IBL is simply the thinking classroom"*.

IBL is a dynamic process that capitalizes on students' natural curiosity about the world they live in: *"Students have a natural urge to inquire….. Curiosity is always evident …. They want to know why, how, when, and where?..... They are never satisfied…. They want to know more about a topic…"*. Curiosity drives learners to search for what they don't know. IBL embraces curiosity, as it takes into consideration students' questions. When students are asked to find answers to their posed inquiries, they become engaged in the learning process and motivated to reach conclusions.

Students engage in activities and tasks that are relevant, meaningful, and above all, authentic. Students also go beyond the facts, and instead think of concepts, patterns, and generalizations: *"IBL calls out for conceptual learning ….. We never stop at the facts, but we go beyond….. We are always thinking of the so what?.... IBL is all related to real life ….. It is real life experience ….. It is authentic…."*. With such conceptual thinking, students reach a deeper understanding and develop a personal intellect that drives them to understand more. It is only when students reach enduring understanding of a certain concept that they are able to retain and transfer their learning to real life situations: *"The learning is transferable….. the understanding is enduring and stays with them …. They are actively involved in the task, they reach a deeper understanding that is easily retrieved in their memory… Students apply their learning to new situations…."*.

Theme 2: IBL Allows for Differentiation and Empowers Student Voice and Choice

IBL is a student-centered approach, where students manage their own learning through open-ended tasks, inquiries, and experiments: *"It is never a one approach to learning…. Students are often engaged in tasks that require thinking and reflection…. They experiment with materials and manipulatives around them to reach conclusions…. Tasks are complex and require students to go further...."* They work in groups, take up roles that bring out the best of their abilities and uniqueness, take control over their learning, and decide on a certain procedure to complete a certain task or answer an essential question: *"Students invest their interests, abilities, and prior knowledge to make meaning and reach conclusions…. They have ownership over their learning…. They decide on how to carry on their inquiry and at times, they also decide on the content… In one of my Science lessons, my students worked in groups and came up with*

their own interest question related to push and pull… While working on the respiratory system, a student asked why people yawn and he carried out his own investigation and research…"

As IBL involves guided and independent research, a wide variety of resources is often offered to students, which provides them with a diversity of choice. The teacher can provide content in the form of text, audio, video, or manipulative. In IBL classrooms, instruction varies and may include different strategies: flexible grouping, graphic organizers, demonstrations, simulations, experiments, I-pad applications, learning stations, and field trips. Students are also given the choice to demonstrate their understanding of a certain concept: *"We often use manipulatives…. I refer to graphic organizers and make use of a variety of visual thinking routines in the classroom…. The different applications on the I-pad reinforce choice – students love it…. Simulations work best for me…. At times we explore in pairs and at other times in groups…. Centers are a great way to attract students' attention and launch a new unit…Learning outside the classroom is important in IBL and reinforces authentic learning… Students can also decide on the way to show their understanding…. They can choose to present or design a poster…. A group decided to show what they learned about the circulatory system by designing a website on WIX…. Three of my students engaged in role play to show their understanding of the muscular system…"* Such a variety of instructional strategies help target each student's learning style and ensures all students have access to content to help them reach understanding. Hence, IBL lends itself naturally to differentiation.

Learning become intrinsically rewarding when students are offered different opportunities to discover and solve problems: *"Students want to learn… They are interested in the questions they pose and they want to find the answers…. They are motivated to learn…. Students are excited… At times, students are all over the place engaging in meaningful discussion and sharing their learning- they are simply happy…."*.

In summary, when students are involved in well planned IBL, directing their own learning towards meaningful and real-world applications, they will be engaged and motivated.

Discussion

The first research question that this study aimed at answering was: What factors hinder the implementation of IBL in the student teachers' classrooms? The findings reported by the student teachers did not support previous research investigations concerning the challenges of

IBL. In her study, Beshears (2012) revealed that teachers considered the following factors as hindering the implementation of IBL in the classroom: lack of background knowledge in content and pedagogy, classroom management, and curriculum design and infrastructure. Participants in this research study did not consider lack of background knowledge in content and pedagogy and classroom management challenging, but they did consider curriculum design and infrastructure as contributing. Walker (2007) presented a list of problems teachers perceive with the implementation of IBL, including: school system, school resources, and the individual teacher. The first of these factors, school system, was mentioned by the participants in this study.

In their study, Saunders-Stewart et al. (2012) derived from a literature review a 21-item criterion referenced inventory which focused on theoretically and empirically based outcomes for students engaged in inquiry. The authors reported a range of benefits: deep understanding of the content area, application of knowledge or skill, acquisition of thinking, problem solving, and personal skills, and increased motivation, self-confidence, and self-efficacy. Stern, Ferraro, and Mohnkern (2017) extended on the above notion and argued that the "goal of instruction is depth of learning and quality of thought that organizes and transfers to new situations" (p. 30). When students reach transfer, deep learning has been accomplished (Fisher, Frey, & Hattie, 2016). Friesen and Scott (2013) emphasized the importance of authenticity in students' learning. They argued that students learn best when the subjects are meaningful to them and interesting. "Students must have an authenticity and a sense that the work being done in classrooms is real work that reflects the living realities of the discipline being taught" (as cited in Friesen & Scott, 2013, p. 11). Byrne, Rietdjik, and Cheek (2016) reflected on the framework of inquiry and explained that students involved in IBL reinforced a variety of essential skills, such as: observation, questioning, planning, recording, communication, and problem solving, and they also developed responsibility and self- autonomy. The data described by the student teachers supported each of the notions brought by Saunders et al. (2012), Stern et al. (2017), Fisher et al. (2016), and Friesen & Scott (2013): *"…Students investigate, solve problems, and draw conclusions about a particular inquiry, which is related to the real-world… They will be engaged more deeply if the learning activities can be applied to real-world situations… They become more creative in applying knowledge that they have learned in other situations and disciplines… IBL is not about memorizing facts – it is about conceptual thinking.... Students transfer their learning to the real world.* In addition, student teachers elaborated on skills that

were previously reported by Byrne, Rietdjik, & Cheek (2016): *"… Questioning and inquiring is all part of IBL, and these strategies allow students to think deeper and more critically in order to find solutions to their questions…. Students are not waiting for the teacher to provide an answer… IBL is not about finding the right answer, but about developing inquiring minds… Students will formulate and reformulate questions, tweak their research methods, evaluate their results and communicate their findings… Students are encouraged to elaborate on their answers, which contributes to meaningful and interesting discussions …. With time, students will learn how to participate in Inquiry-based Learning Cycles and gradually move from structured to guided and eventually open inquiry – they acquire a sense of responsibility*.

Data from student teacher responses also indicated that IBL empowers student voice and choice, which naturally increases motivation and leads to differentiation. Armstrong (2016) presented a wide spectrum of choices that teachers can make accessible in their classroom. He mentioned that choices could be small or limited, open ended or significant, and they could be related to content (what do you want to inquire about?) or process (how do you want to show what you have learned?). When students are offered different choices in the classroom, they become engaged in the task, put effort to complete the task, and their overall performance improves (Patall, 2013). In their study, Bayram et al. (2013) concluded that IBL promoted motivation in the classroom because students were provided with a variety of choices, given the chance to reinforce self-regulation, and carry out investigations they are interested in. According to Vasquez, Sneider, and Comer (2013), it is crucial that teachers include problem and project based approaches, which are elements of IBL, in the design of learning engagements. These approaches allow students to express their knowledge and understanding in various ways and emphasize differentiation. The findings of this study supported the relationship that previous research had showed between IBL, student voice and choice, motivation, and differentiation: *"….It honors the way students choose to learn and acquire knowledge…. Students have control over their learning…. They are provided with a variety of choices…. When students are allowed to ask questions, especially questions that mean something to them, questions that they want to find answers to, then they are invested in the learning process…. As a Science teacher, I can start a new unit by asking students to brainstorm a list of questions they are interested in exploring – they become motivated to find answers to their questions…. Inquiry-based learning is also centered around students' own interests and questions, which allows for differentiation…*

Students will be exploring different questions…. Some might choose to design a poster, others might choose to prepare a short movie – some might go for a PowerPoint presentation…"

Although the study's research questions were fully addressed, explored, and answered, the following study has two main limitations. First, the sample consisted of eight student teachers, where two of the student teachers did not complete the online survey because they were not teaching at the time. The participants of the study hereby were not enough to make any kind of projection as to the reliability of these findings and their contribution to the understanding of IBL and implementing it in classrooms. Hence, the results of this study cannot be generalized beyond the current participant sample. Second, this sample of teachers was purposefully selected for their enrollment in the teaching methodology course.

It is recommended that future studies connect some work in content specific IBL models, such as Math and Science and examine the differences between IBL across different content areas. It is also important that future studies investigate how IBL is implemented in the humanities discipline. Present research tends to focus on math and science disciplines and seldom considers how IBL can be successfully included in other disciplines. It is also recommended that future studies explore the benefits of IBL from students' perspectives. It is important that research sheds light on students' thoughts, opinions, views, and feelings on IBL.

Conclusion

It is important for us to remember that our students are 21st century learners, hence we cannot teach them in the same manner as we taught yesterday's students. Our students need to be involved in the learning process. They need to formulate their own questions, direct their learning, be responsible for it, and show ownership. For this to happen, educators have to have a growth mindset and strongly believe that all students today can be trusted to take responsibility for their learning journey.

If IBL is effectively implemented by a skilled teacher who is willing to teach, reteach, and model patterns of thinking, then students will be involved in a classroom culture that reinforces collaboration, problem solving, reflection, differentiation, motivation, and above all, transfer of knowledge and skills to new situations in and beyond the classroom. With continuous professional development, collaboration with experienced inquiry-based educators, and with careful planning and gradual implementation of IBL units, students can reap the benefits of

inquiry in the classroom: A classroom that nurtures curiosity, establishes a culture of deep learning, and creates engaged and motivated learners.

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