Black Swan Theory and PBL in Japanese Universities

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This paper describes how black swan theory can be applied to better understand the educational methodology called problem-based learning (PBL) that was introduced into Japanese medical universities 25 years ago. While many universities still struggle with its implementation, a few have been successful. What accounts for this great disparity? This paper describes how identifying black swan events can assist with improving PBL so Japanese students can experience more successful learning.

本論文では、どのようにブラックスワン理論を適用すれば、25年前に日本の医科大学に導入されたチュートリアル教育（PBL）と呼ばれる教育方法論をよりよく理解できるのかを説明する。多くの大学がPBLの導入・実施に苦労している一方、成功している事例も存在する。この違いはいったい何だろうか。本論文では、どのようにブラックスワンイベントを特定すれば、PBLを改善して日本の学生の学習がより成功することができるのかを検討する。

EXPECT THE unexpected; it is easier said than done. Most teachers have experienced classes where something unexpected has occurred and have struggled to come up with reasons why. While researching the topic of the evolution of problem-based learning (PBL) in Japanese medical universities, I identified numerous behavioral and outcome-related anomalies that were outside the expectations of the administrators who oversaw program implementation. In an attempt to understand the reasons behind such anomalies, I applied a theory from financial analysis that provided a workable framework for interpreting and understanding how and why anomalous events take place and how these can be used as a learning experience to address issues that had escaped previous attention to fine-tune a program and make it more robust. This paper will first describe the concept known as black swan theory then show how it applies to educational situations, in particular PBL, and suggest how it can be used to improve the quality of students' education.

Black Swan Theory

The inspiration for black swan theory (BST) lies in European history. For thousands of years, the conventional wisdom in Europe was that all swans were white. Unexpectedly, 17th century Dutch explorers to Australia discovered, along with Australia's other exotic animals, the existence of black swans in Western Australia. Yet despite returning to Europe with black swans to prove their discovery, many people refused to reject conventional wisdom, instead claiming that these were merely

white swans painted black—seeing was not believing! This example highlights the three major elements of BST: The discovery (event) was unexpected; it had the major effect of demolishing a long and widely held belief; and, most importantly, an irrational defense was made to maintain the validity of conventional wisdom after the event. BST was primarily framed in regards to major historical events that exerted oversized influences on human existence, without consideration that equally paradigm-shifting events also take place at the micro-level. However, it wasn't until a series of major financial crises began to shake the world in 1998 that BST was reinterpreted and found new applications.

The theory of black swan events was developed by financial analyst Nassim Nicholas Taleb (2007) to explain

1. how unexpected events beyond normal expectations have exerted oversized influences in science, finance, and technology;
2. how such aberrations usually escape detection, even detection procedures using scientific methods, due to the nature of their unlikely probabilities; and
3. the psychological biases for individual and collective blindness to such rare occurrences even in hindsight.

As mentioned earlier, this concept can be used to examine anomalous events that take place in educational settings and assist in understanding what changes may need to be implemented so that educational goals can be better realized. The main idea in Taleb's (2007) book is not that black swan events can always be predicted, but that people should learn that such events can occur and be prepared for negative occurrences as well as being able to exploit positive ones.

There are many events taking place in educational settings that would benefit from the application of BST. Its utility stems from how it highlights that any system of beliefs is fragile (e.g., who should teach or facilitate; and about students, their study habits, test performance, and acquisition of knowledge) and could be undermined or undone by an unexpected occurrence or series of events. Used to analyze unexpected events, BST can particularly focus attention on those elements that underpin failures and call conventional wisdom into question. Indeed, any set of ideas can potentially fall into disarray once any one of its fundamental postulates is found questionable or is suddenly disproved. As Taleb showed how the observation of a single black swan was the undoing of a long-held belief, the basis of any system of ideas, as well as the reasoning that flowed from it, can easily succumb to the same fate and be rendered invalid.

Identifying a BST Event

To identify whether or not a BST event has occurred, it is first necessary to identify some guidelines. In this study, the following criteria were used to identify when an occurrence could be classed as a BST event:

1. The event was surprising and unexpected in the experience of the teacher, tutor or facilitator, or administrator.
2. The event was outside normal parameters.
3. The event had a significant effect on outcomes or processes.
4. The event may have changed future expectations.

There are several BST events in Japanese education that illustrate these criteria. First of these are the results of the *yutori kyoiku* (translated as "relaxed education") policies that were implemented by the Japanese national government as a response to calls that Japanese educational requirements were placing too heavy a burden on high school students (O'Dowd, 2006). These policies, intended to improve the performance of Japanese students, were subsequently blamed for accelerating declining student standards and worsening student behavior. A second example comes from a news story in *The International Herald Tribune* titled "Internet Shifts Views on Knowledge" (2011) that lamented the dependence of Japanese students on the Internet with regard to cheating, copying, and shunning knowl-

edge building in favor of shortcuts. Rather than using the Internet and ubiquitous smart phone technology as tools for building and supporting knowledge acquisition, the Japanese students cited in the article took actions that surprised their teachers, who believed the students would apply themselves more academically, creating a minor BST event. Finally, my own research into student motivation after entering university revealed a cornucopia of BST events that each had serious impacts on student performance in their studies (O'Dowd, 1996, 2006). In each example, the event was a surprise to the observer, was outside expectations, had a significant unwanted effect on intended outcomes, and has changed future expectations. In the following sections, I will describe how these criteria were applied to identify BST events in practicing a common teaching methodology used in medical universities both in Japan and overseas.

Problem-Based Learning (PBL)

Rather than the traditional didactic approach by which a teacher spoon-feeds students content through lectures, PBL challenges students to "learn to learn" by working cooperatively in small groups to unpack and explore the dimensions of real world problems. PBL is based on the idea that a study program should primarily develop students' learning and thinking abilities in order for them to gain a deeper understanding of course materials and be better prepared to face real-world challenges after graduation.

However, the beliefs about education this approach is based on are quite different from the usual educational experiences of Japanese students who enter university directly from high schools and cram schools where teachers direct students to learn specific content (e.g., from exam preparation books), which is subsequently tested in examinations. Indeed, a tutorial-style learning environment (i.e., PBL) is far outside the usual experience that students have been accustomed to in the normal Japanese educational system (Oda & Koizumi, 2008; O'Dowd, 2006, 2011). As a result, many of the problem events arising after the implementation of PBL tutorial programs in Japanese universities have stemmed from students' unfamiliarity with the methodology. This is not to suggest that Japanese students are incapable of performing well in tutorial education, but rather that the problems stem from the beliefs of administrators who introduce such programs.

In addition, as PBL programs have been introduced in universities around the world, their suitability and applicability have sometimes been called into question in various cultural settings, for example, in Asia and the Middle East (Al-Eraky, 2013; Gwee, 2008). Difficulty in communication between students as well as with their facilitator has been a major criticism of PBL (Hoon, 2003; Oda & Koizumi, 2008), and cultural factors have been attributed to this problem, not only in Japan but in other cultural settings as well (Al-Eraky, 2013; Gwee, 2008; Hoon, 2003). Thus, some of the problems (i.e., BST events) observed may in fact be derived from cultural factors. In response, academics from various countries have addressed this question (e.g., Al-Eraky, 2013; Frambach, Driessen, Chan, & van der Vleuten, 2012), and they have argued that PBL needs to be adjusted to accommodate the various educational belief systems already in place.

PBL Process

PBL has an established framework and its implementation is easily recognizable, although some tinkering has occurred as it has evolved both in different countries and at the local level (O'Dowd, 2013). Here is a basic outline of the stages of PBL as it is usually practiced:

- Each class is divided into small tutorial groups of approximately 5-10 students each.
- Each tutorial group has a tutor or facilitator who oversees the discussions and interactions and guides the students through each phase of the problem being studied.
- In each tutorial, students must each play a role (e.g., discussion leader, scribe, resource person, time-keeper, etc.) to develop

team skills as well as to move the tutorial forward in a structured manner.

- Students are presented with a series of tailored problems, based on course materials and goals, to engage the students' interest and stimulate learning of the target subject matter.
- Students pool their current knowledge of the topic and list it as "What do we know?"
- Discussion and analysis then enables them to construct a problem statement or hypothesis. This is a starting point and may be revised as assumptions are questioned and new information is added.
- The group then identifies the learning issues (LI) they believe each new problem presents. Under the heading "What do we need to know?" (NTK), students develop questions that must be answered to address missing knowledge or to illuminate the problem.
- Under a third heading, "What should we do," students decide how to divide their labor to resolve these questions and record matters such as what specific actions must be performed by the next tutorial. Students then gather information from all available sources: the school's library, the Internet, and experts on the subject.
- In the following tutorial, the students collaborate by sharing their findings and new information on the learning issues they were each assigned in the previous tutorial. Next, they discuss the application of their findings to the elements of the case problem. This process continues until the target topics of the case problem have been covered, as determined by the tutorial facilitator.
- In the final stage, students reflect on the process they have carried out and on the content knowledge they have studied through the module's problem.

As can be seen by the various stages of this process, such a learning environment is far outside the usual experience in the Japanese educational system (O'Dowd, 2011). Nevertheless, the adoption of PBL has become *de rigueur* in modern medical curriculums, thus making it an essential part of medical education both abroad and in Japan. It is the unfamiliar nature of PBL tutorials that is initially somewhat befuddling to students and their facilitators (O'Dowd, 2005), allowing opportunities for BST events to occur.

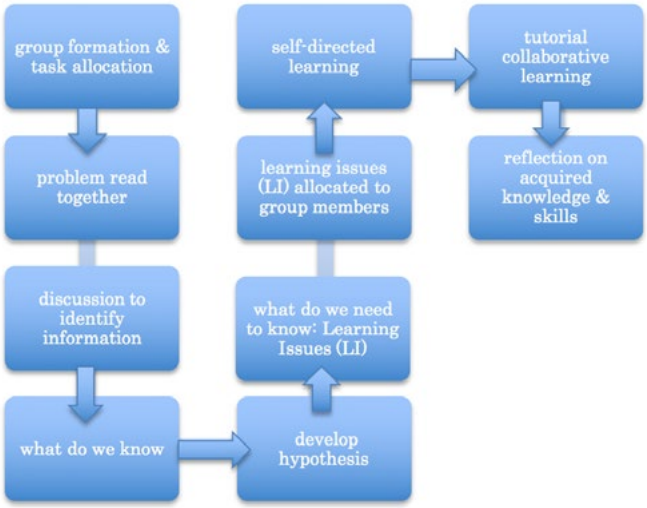

Figure 1. PBL tutorial process.

BST Events in PBL

While observing 160 PBL tutorials at five Japanese medical universities over a 3-year period, I recorded a number of events that were outside the expectations of both the researcher and program administrators. These anomalies—some minor, some not so minor—

should not be regarded as mundane curricular failures as all showed how the process and goals of tutorials were undermined by a set of beliefs and yet, after the events, how they could be rationalized and even ignored by those overseeing the processes. Some examples include the following:

Students

1. One group sat in silence for 8 minutes; no one moved or talked, including their facilitator.
2. No students turned up for their tutorial; the facilitator left the room after 15 minutes.

Tutors

3. Sat in the tutorial room, with students, reading a newspaper for an hour.
4. Sat in the corner of the room without speaking to students.

Administration

5. Issued and collected feedback forms but filed them away without processing them.
6. Video recorded all tutorials but no one viewed them after the events; no one has explained why videoing is necessary.

I consider BST to be a useful framework for interpreting and understanding how and why such events take place and how they can be used as a learning experience to address issues that are sometimes rationalized away. One example is the belief that students use cellphones in class only for study purposes, to fine-tune their approach to problem-solving, and make their educational processes less prone to recurring failures, when in fact they often use them to relieve boredom by playing games on their phones.

In example 1 above, when neither the students nor their facilitator spoke at the beginning of the tutorial, the main problem lay in their mutual lack of understanding about their roles. The author found that inadequate orientation was a major factor for both students and facilitators in this regard. The students had not allocated tasks beforehand as was expected, and no one was willing to make the first move by themselves, hence the lack of movement. The facilitator did not fulfill his assigned role as he misunderstood what was expected of him, responding along the lines of "in PBL the students are supposed to do everything themselves without being taught by the facilitator." The basic failure highlighted here is that both the students and the facilitator were not fully aware of the preparation and guidance needed. A better initial orientation is needed to ensure a full understanding of the roles each party should play to achieve a successful outcome.

In example 2, the medical students did not believe that tutorials were as "serious" as regular lectures and therefore not important enough for full attendance. Attendance can be problematic in Japanese national universities. Although universities can set a higher requirement, the fallback position of both students and administrators remains the national guidelines that only require a minimum two-thirds attendance of classes. PBL, however, requires a higher degree of time focus due to the limited time available for tutorials and the number of problem cases per semester imposed by the curriculum. The three Australian medical universities and one American medical university that I visited in the course of researching PBL all required full attendance for all tutorials, with exceptions being rare.

Examples 3 and 4 also show how facilitators can drop the ball during tutorials if they do not fully understand their purpose in being there. Although tutorials are student centered and require self-directed learning, it is a mistake to think that tutors are just *babysitting* their groups. Facilitators should play a critical role in keeping the students focused and engaged in the processes in a timely manner. They can also engage as a mentor, for example, by giving real-life examples and advice, guiding the students to stay on track, and ensuring they get the most out of their tutorial experiences.

Examples 5 and 6 show that it is not only unexpected occurrences concerning the students and their facilitators that affect tutorial learning but also the belief set of those who administer the programs. When I questioned one facilitator about such actions by administration staff, it was suggested they often lost sight of the final goals because their focus was primarily on the daily mechanical processes. And although the recorded data still exists, trying to access it often becomes another administrative hurdle because it falls outside of the normal expectations of daily activity. Of course, academic administrators have their own approaches, rhythms, and pace that encapsulate the conventional wisdom of each institution, so it should not be surprising that black swan events can be found and observed at any institution.

Recommendations

The following is a list of recommendations that have been derived from examining numerous BST events observed in PBL tutorials in universities over the past 3 years.

- BST events are learning experiences—don't ignore them.
- Students and facilitators both need a lot of orientation to be able to understand what is expected of them.
- Periodically re-examine students' beliefs about PBL tutorials.
- Address students' beliefs about their learning and goals.
- Make overt reminders to students that the development of metacognitive skills is an important part of the course goals and learning outcomes and should not be ignored.
- Be more explicit in dealing with students than you may think necessary.
- Provide students with performance criteria for their tutorial assignments from the outset so they become familiar with expectations.
- Make group planning a central goal of each assignment.
- Use guided peer reviews so students can understand how both peers and facilitators have perceived their efforts.
- Have students do guided self-reflections and self-assessments.
- Prompt students to analyze the effectiveness of their study skills.
- Present multiple strategies for ways that a task or problem can be conceptualized, represented, or solved.
- Ensure that tutors or facilitators understand their role in tutorials and give feedback.

Nevertheless, even if all these recommendations were accepted and acted upon, one could still be reasonably certain that another BST event will arise and bring new issues into focus. It is only through understanding the nature of BST events that educators can prepare themselves for when they do occur and can take positive actions rather than making rationalizations that suggest that no action is required.

Conclusion

Even after 25 years of implementation and modification of PBL in Japanese medical universities, the unexpected can still arise. By gaining a better understanding of the nature of BST events and recognizing that changes to systems present both new problems and subsequently opportunities to make improvements that were not previously envisaged, educators can act upon such occurrences in tutorial situations to further modify behaviors and produce for the students better outcomes from the tutorials and better futures as medical practitioners.

Bio Data

Gregory V. G. O'Dowd, from Brisbane, Australia, was awarded his Masters of Arts (TESOL) from Columbia University Teachers College and is the foreign language instructor at Hamamatsu University School of Medicine. His research interests include speaking and

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