INNOVATION-BASED LEARNING CONCEPTUAL MODEL

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ABSTRACT

The advantages of student-centered teaching approach are well documented in the literature. These include improving active learning, self-directed learning, interdisciplinary knowledge, various process competencies and encouraging a deeper approach to learning. This paper explains how the innovation process is accommodated in teaching and learning Food Technology course that leads to the development of Innovation Based Learning (IBL) conceptual model. The IBL offers a significant alternative of student-centered teaching approach from the conventional lecture-based approach. The paper also presents result of IBL application from the perspective of 30 final year students who enrolled the course. Mixed method research design was used to conduct this study. Qualitative data were collected through classroom observation, interview and documentary evidence while questionnaire was used as research instrument for survey research method to collect quantitative data from the students. Result of the survey shows that all phases in the IBL conceptual model were highly applied with mean average value = 4.25 and standard deviation = 0.3430. The dynamic IBL conceptual model developed also been applied in teaching two practical-based of Technical and Vocational Education and Training courses, which are Fashion Design and Invention that offered by Technical and Engineering Education programme.

Keywords: Innovation, Teaching Strategy, Conceptual Model

INTRODUCTION

Japan is a developed country that relies much on product innovation that develops through innovation process. To help Malaysia become a developed country like Japan, educational practices in education institution of Malaysia should apply teaching strategy that involves innovation process to expose and educate young Malaysian generation the process of developing innovated products and or services from the early stage.

In 21st century where employment is very competitive, teacher-centered teaching approach that mostly applies lecture-based and teaching and learning process dominated by teachers has faced paradigm shift to student-centered teaching approach where student acts actively as key player in the classroom while teacher as facilitator. The student-centered teaching approach promises the student with in-depth understanding and competency of technical content knowledge of the subject matter (Robert & Scott, 2009) and mastery in variety of generic skills (Ruhizan & Saemah, 2011). These core and generic skills are two major employability skills that the employers looking for employing new staff.

Teacher-centered teaching approach had been practiced for decades. Therefore, researchers and instructional practitioners consider the student-centered teaching approach that introduced in the 21st century as innovative teaching approach (Lalima & Kiran, 2017). Among teaching strategies under the student-centered teaching approach are cooperative-learning, collaborative-learning, project-based learning, problem-based learning, blended-learning, scenario-based learning, service-learning, project oriented problem-based learning. Those teaching strategies received vast attention in classroom practices and in the literature.

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Both the cooperative and collaborative-learnings where students learn in small group able to maximize the students’ own and groups’ learning (Robert, 2013). In project-based learning, students work on a project over period of time (week or up to a semester). This engages the students to produce an authentic and meaningful project in solving a real-world problem (Boss & Larmer, 2018). The problem-based learning allows students to focus on how and what they will learn about unfamiliar problem, situation or task using their prior knowledge in the topic area related to the problem. They are required to identify gaps in their knowledge as they attempt to solve the problem (Delisle, 1997).

The blended-learning that synonym with flipped classroom describes the way e-learning is being combined with traditional classroom methods and independent study to create a new, hybrid or mixed or integrative teaching methodology (Lalima & Kiran, 2017). The use of technology as a medium in teaching and learning process is a main concern of this teaching strategy. The scenario-based learning on the other hand uses virtual, interactive, problem-based contexts as a way of teaching or practicing a skill. In the teaching, students working through a problem to be solved applying prior experience, subject knowledge, critical thinking, and problem solving skills in a risk-free and “close-to real-world” environment (Dalziel, 2012). Service-learning that also known as community service-learning or academic service-learning or community based-learning or community experiential learning integrates student experience in the community to academic learning. The objectives are to enrich their learning experience, enhance sense of civic responsibility and strengthen communities (King, 2010). The teaching strategy of project oriented problem-based learning involves identifying, analysing problem and designing project to solve also the real world problem. This exposes students to the development of analytical skills and communication skills to argue and present solutions to the problem and answer potential challenging questions (Noraini & Shahliza, 2013).

However, to date, there is no specific teaching strategy found in the literature that introduce structured innovation process that leads to the development of innovative either product, service, process or application as an output of teaching and learning process. The available student-centered teaching strategies reported in the literature also do not provide a systematic and comprehensive teaching process conceptual model to produce innovative student. Thus, the aim of this paper is to introduce Innovation-Based Learning (IBL) conceptual model development as well as to report the application of IBL teaching strategy from student perspective.

LITERATURE REVIEW
Innovation and Its Process
Innovation means making new ideas, products, services, processes and applications to be used. The innovation is also known as a change of products and or services in a way that they can adapt to rapid changing in market (Cerit et al., 2014). The innovation can be used as a strategy to startups, to get to the top and to stay on top of any business.

Robert (2013) introduced 8 phases of innovation process in business as below:

i. Generating ideologies: Use basic internal and external SWOT analyses of current market trends.

ii. Screening the idea: Identify top three competitors, market share, benefits that end consumers could expect, set specific criteria for ideas that should be continued or dropped.

iii. Testing the concept: New product development, knowing where the marketing: does the consumer understand, need or want the innovated product and or service?

iv. Business Analytics: Build a system of metrics to monitor progress such as average time in each stage, output metrics that measure the value of launched products, percentage of new product sales and other figures that provide valuable feedback. Keep the ideas as a valuable asset for future products and a basis for learning and growth.

v. Beta/ Marketability Tests: Arranging private tests groups, launching beta versions, and forming test panels (after the product or products have been tested) to provide valuable information for last minute improvements and tweaks.

vi. Technicalities and Product Development: Is a process before sending technical specs to machinery. It is final database preparations, estimation of server resources, and planning automated logistics. This stage involves printing MSDS sheets, retaining an ISO 9001 certification (the organizational structure, procedures, processes and resources needed to implement quality management).

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vii. Commercialize: Is a stage where consumers purchase good or service developed, while technical support is consistently monitoring progress: keeping distribution pipelines loaded with products, refreshing advertisements to keep product’s name firmly supplanted into the minds of potential customers.

viii. Post Launch Review and Perfect Pricing: Review the new product development process efficiency and look for continues improvements, differentiate consumer needs as the products age, forecast profits and improve delivery process. Ensure internal costs aren’t overshadowing new product profits.

![Figure 1. Conceptual model of innovation process (Robert, 2013)](image)

Altshuller proposed five levels of innovation as follow (Yezersky, 2008):
Level 1: A simple improvement of a technical system. It requires knowledge available within a trade relevant to that system. (This is not really innovative because it provides only an improvement to an existing system without solving any technical problem).
Level 2: An invention in resolution of a technical contradiction. It requires knowledge from different areas within an industry relevant to the system.
Level 3: An invention in a resolution of a physical contradiction. It requires knowledge from other industries.
Level 4: A new technology that improve upon a technical system and solves the problem by replacing the original technology with a new technology.
Level 5: Discovery of new phenomena that allows pushing the existing technology to the higher level.

Theory of Inventive Problem Solving
TRIZ is Russian acronym for the Theory of Inventive Problem Solving developed by Russian Scientist Genrich Altshuller in 1940’s. The TRIZ is a set of systematic thinking tools to help to improve ‘system’ in innovative way either for solution or starting from zero. Altshuller believed that innovation represents a fundamental change to a technological system and is therefore subject to analysis. It provides a structured way of doing innovations and changes the way an engineer would approach a problem. Problem solving using TRIZ has 6 steps, which are (Hirst, 2011):

a) Define objective and situation
b) Problem Formulation and brainstorming
c) Prioritize directions for innovation
d) Develop concept
e) Create a plan to implement concepts
f) Evaluate results

METHODOLOGY
This study adopted mixed method research design that started with qualitative research method to develop IBL conceptual model through teaching and learning of Food Technology course. Qualitative data were collected through classroom observation and interview with lecturer and students. The data were supported with documentary evidence. The quantitative survey research method was adopted to identify students’ perception towards the application of IBL in the course. The quantitative data were collected using questionnaire from 30 final year students who enrolled the course as sample and population of the study. The Food Technology is a two credit practical-based course that consists of theory and practice components. To get effective teaching and learning process, maximum number of student allowed by Malaysian Quality Assurance (MQA) for one section of practical-based course is only 30 students. Descriptive quantitative analysis using the statistics of mean and standard deviation were used to analyze the quantitative data and assisted by computer software of Statistical Package for the Social Sciences (SPSS) while qualitative data were analyzed according to theme through cording process.
RESULTS AND ANALYSIS
Conceptual Model of Innovation-Based Learning
The Robert’s (2013) innovation process in business and TRIZ model (1940) for steps in problem solving were adapted to develop the IBL conceptual model. The conceptual model consists of four major phases which are Preparation, Delivery, Output and outcomes and Reflection (refer to figure 3) and it runs in a cycle form. The cycle repeated continuously for quality improvement (CQI) of the course for the following semester until saturation point is achieved (refer to Figure 2). At this point, no more improvement will be done in each phase of the teaching strategy.

**Figure 2.** The cycle of innovation-based learning conceptual model for CQI

**First Phase: Preparation**
This phase is conducted before the course commences. Two aspects to be prepared are knowledge for technical content of the course, pedagogical aspect of student-centered learning and knowledge about innovation process. This followed by preparing teaching materials as follow:

a) Students profile who enroll the course to identify students’ academic background diversity
b) Course Outline (refer to Table 1-4)
c) Guideline of problem crafting and problem solving
d) Assessment rubrics for sensory evaluation of the innovated food product, poster presentation, food packaging, and final report of the innovation process for the innovated food product development
e) Intellectual property application form

**Figure 3.** Sarimah’s Conceptual model of innovation-based learning
f) List of relevant food industry that may provide information concerning any problems about food like food marketing, food processing, food technology, food nutrition, food ingredient, food shelf life and food demand

g) List of food research institution that may provide professional advice related to the development of food product innovation

h) Templates for application letter for field visit to food industry and food research institution

i) Certificate of participation in innovation exhibition

j) Award for innovation competition

Table 1. Course constructive alignment

<table>
<thead>
<tr>
<th>No.</th>
<th>CLO</th>
<th>PLO (Code)</th>
<th>*Taxonomies and **Generic Skills</th>
<th>T&amp;L Methods</th>
<th>***Assessment Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLO1</td>
<td>Possess knowledge and skills of food technology at all levels of Bloom taxonomy (from remember to create)</td>
<td>PLO1 (KW)</td>
<td>C4</td>
<td>Lecture and active learning</td>
<td>Final examination</td>
</tr>
<tr>
<td>CLO2</td>
<td>Demonstrate skills in food processing technology</td>
<td>PLO2 (AP)</td>
<td>AP4</td>
<td>Innovation-Based Learning</td>
<td>Weekly practical</td>
</tr>
<tr>
<td>CLO3</td>
<td>Produce innovated food</td>
<td>PLO5 (TH)</td>
<td>TH3</td>
<td>Innovation-Based Learning</td>
<td>a) Sensory evaluation, b) Packaging and labeling, c) Poster, d) Research Proposal</td>
</tr>
<tr>
<td>CLO4</td>
<td>Present food innovation process</td>
<td>PLO4 (CS)</td>
<td>CS3</td>
<td>Innovation-Based Learning</td>
<td>Food innovation report</td>
</tr>
</tbody>
</table>

Table 2. Weekly schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Teaching and Learning</th>
<th>Topic of Lecture/ Practical Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Theory-based</td>
<td>Introduction to the course</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Technology in food processing</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Halal food and food additive</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Food packaging and labeling</td>
</tr>
<tr>
<td>5</td>
<td>Practical-based</td>
<td>SWOT analysis on food market trends and problem identification</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Verification problem identified suggestion for problem solving</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Proposal presentation for innovation plan</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>R&amp;D 1: Product innovation development</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>R&amp;D 2: Product innovation development</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>R&amp;D 3: Product innovation development</td>
</tr>
</tbody>
</table>

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Second Phase: Delivery
The Delivery Phase consists of seven stages of teaching and learning activities as below:

1. **Introductory of the Course**
   The Introduction to the course has three components as below:
   a) Introducing content of course outline (course synopsis, course learning outcomes, assessment types, weight of each assessment type, IBL as main method in teaching the course (refer to Table 1), course weekly schedule (refer to Table 2), student learning time (refer to Table 3) and assessment types (refer to Table 4)
   b) Dividing students into small groups (2-4 students/ group) with diversity academic background.
   The students will work in group throughout the semester

2. **Problem Identification**
   The following activities take place in this stage.
   a) Identifying problem related to food in the market through SWOT analysis from the following informants:
      i) Society- based on their daily life experience consume the food product

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### Table 3. Student learning time (SLT)

<table>
<thead>
<tr>
<th>Course Learning Outcome</th>
<th>Guided Learning (Face to Face)</th>
<th>Teaching and Learning Activities</th>
<th>Total SLT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Guided Learning Non-Face to Face</td>
<td>Independent Learning Non-Face to face</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lecture</td>
<td>Tutorial</td>
<td>Practical</td>
</tr>
<tr>
<td>CLO1</td>
<td>4h</td>
<td></td>
<td>8h</td>
</tr>
<tr>
<td>CLO2</td>
<td></td>
<td>8h</td>
<td>2h</td>
</tr>
<tr>
<td>CLO3</td>
<td>27h</td>
<td>8h</td>
<td></td>
</tr>
<tr>
<td>CLO4</td>
<td>8h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4h</td>
<td>35h</td>
<td>10h</td>
</tr>
</tbody>
</table>

### Table 4. Types of Assessment

<table>
<thead>
<tr>
<th>No.</th>
<th>Continuous Assessment</th>
<th>PLO (Code)</th>
<th>Percentage</th>
<th>SLT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Weekly practical</td>
<td>PLO2 (AP)</td>
<td>10</td>
<td>8h</td>
</tr>
<tr>
<td>2</td>
<td>Innovated food development</td>
<td>PLO5 (TH)</td>
<td>40</td>
<td>32h</td>
</tr>
<tr>
<td></td>
<td>a) Sensory evaluation (20%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Packaging and labeling (5%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Poster (5%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>d) Research Proposal (10%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Presentation</td>
<td>PLO4 (CS)</td>
<td>20</td>
<td>16h</td>
</tr>
<tr>
<td>4</td>
<td>Final Examination</td>
<td>PLO1 (KW)</td>
<td>30</td>
<td>24h</td>
</tr>
</tbody>
</table>

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ii) Food industry-based on their experience marketing and producing the food product
b) Searching information related to the problem from various resources to identify solution for
the problem
c) Discussing problem and solution for problem solving with course lecturer for verification

3. Proposal Defense
   In this stage, students are required to:
   a) Prepare research proposal for innovation process
   b) Present the research proposal for defense

4. R & D and Reflection
   This stage is where the students conducting series of guided R&D in the laboratory to produce the
   innovative food product. The R&D activities are based on plan stated in research proposal.
   Objective, result and reflection of each R&D session are recorded for improvement of the next
   R&D activity.

5. Intellectual Property Application
   In this stage, students are guided to fill online form to apply for Intellectual Property (IP)
   certificates of the innovated food product (trade secret), labeling (copyright) and packaging
   (patent) to secure their intellectual property. The application is conducted before the innovated
   food product and it packaging been exposed to public through the activity of assessment,
   exhibition, competition and commercialization.

6. Assessment
   The assessment involves both types, formative and summative. The summative assessment
   measures content knowledge of the course through final examination. The formative assessment
   measures student’s experiential learning process of the following aspects:
   a) Skill of the course is measured via weekly hands on laboratory activities,
   b) The generic skills are gauged through:
      i) oral presentation during proposal defence and reporting the innovative food product been
         developed to measure communication skills
   ii) written final report of innovation process provides platform to assess students’ effort,
       innovation and creative thinking and problem solving. A complete of final report consist of the
       following elements:
        • Activities been conducted in all stages of the IBL delivery
        • R&D plan and progress
        • Innovative food product been developed in terms of features, novelty, cost, market size, market
          competitors, packaging and result of sensory evaluation
   Panel of assessors to evaluate end innovated food product are course lecturer, entrepreneurs from the
   relevant food industries, expert of food research institution and winners of innovation competition
   among lecturers.

7. Product Commercialization
   The innovative food product developed opened to public for commercialization take place after
   assessment sessions.

Phase Three: Outputs and Outcomes
Outputs of the IBL are in a form of innovated food product, IP certificates, product commercialization,
certificate of participation in innovation exhibition and award for innovation competition. The
outcomes of overall learning process adopting the IBL teaching strategy are in-depth understanding of
the course technical content and generic skills.

Phase Four: Reflection
In this phase students reflect their one semester experiential learning of the course, give suggestion for
CQI of the course and make peer assessment for team working skills.

Students’ Perception towards the Application of Innovation-Based Learning
Result of the survey for the application of IBL in teaching and learning Food Technology course is
stated in Table 5. The statistics shows overall mean of the IBL application is at high level for each
Phase of the IBL process with average min value = 4.25 and standard deviation = 0.343. The result
indicates that teaching and learning of Food Technology course has applied all phases of the IBL conceptual model been developed.

Table 5. Level of IBL application in teaching and learning food technology course

<table>
<thead>
<tr>
<th>No.</th>
<th>Phases of Innovation-Based Learning</th>
<th>Application</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Mean Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Preparation</td>
<td></td>
<td>4.35</td>
<td>0.394</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>Delivery</td>
<td></td>
<td>4.32</td>
<td>0.360</td>
<td>High</td>
</tr>
<tr>
<td>3</td>
<td>Output</td>
<td></td>
<td>4.26</td>
<td>0.349</td>
<td>High</td>
</tr>
<tr>
<td>4</td>
<td>Outcome</td>
<td></td>
<td>4.20</td>
<td>0.403</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>Reflection</td>
<td></td>
<td>4.14</td>
<td>0.211</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Overall Mean</td>
<td></td>
<td>4.25</td>
<td>0.343</td>
<td>High</td>
</tr>
</tbody>
</table>

DISCUSSION
Learning Theory Underpinning the IBL Teaching Strategy
In IBL teaching strategy, students construct their knowledge and experience as they involve in the learning process to develop innovative product. In the process to solve the problem, the learning process engages the students with innovation process that starts with analysing Strength Weakness Opportunity and Threat (SWOT) of food problem, applying knowledge and skills of the course technical content, conducting field visit to observe the problem in a real setting, and conducting R&D to produce innovative food product. Along the teaching and learning process, lecturer acts as a facilitator helping the students to understand the innovation process to achieve the final outcomes.

The process shows that the IBL teaching strategies requires students’ active participation in their own learning. This is seen able to provide the students with opportunities to interact with sensory data, and construct their own world of learning experience. The IBL teaching strategy blending together learning theories of behaviourism, cognitivism, constructivism and connectivism learning theories as follow:

a) Learning is an active process in which the students use sensory input and constructs meaning out of it. The learning process engaging the students with the world of searching and developing the innovative food product.

b) Students learn to learn as they learn due to learning consists of both constructing meaning and constructing systems of meaning.

c) Lecturers provide activities which engage the students’ mind and physical as the crucial action of constructing meaning is mental.

d) Learning involves language that influences learning because people talk to themselves as they learn.

e) Learning is a social activity that intimately associated with other human beings like lecturers, peers, key person of food industry, experts of food research institutions as well as casual acquaintances, including the people before the students or next to the students at the exhibit. This social aspect of learning uses conversation to interact with others. The application of knowledge is seen as an integral aspect of learning.

f) Learning is contextual where it cannot be separated from lives.

g) Prior engaging the students with problem identification and making decision for problem solving, they are exposed with content of the course to provide them with sufficient technical content knowledge and skill and apply the technical content in R&D for innovative food product development. This shows that a new knowledge is assimilate and build on from previous knowledge. As a result, they are not only mastery the subject content but also will possess various generic skills including research skills.

h) In R&D activity of Delivery Phase, students are required to revisit ideas, ponder them, try them out and use them. This cannot happen in the 5-10 minutes spent in a Food Processing laboratory but
involves long period of experimental. This indicates that the learning is ongoing process and takes time.

i) Motivation is a key component in learning to help learning process and to apply the knowledge gained. It can be achieved through guided facilitation by the lecturer in each phase of learning process and rewards for the outputs and outcomes that the students will get after assessment process.

The Advantages of IBL Teaching Strategy to Students Learning

Four phases of the IBL conceptual model provide platform for students to increase understanding of technical content knowledge of the course as well as strengthening generic skills. Main outcome of the IBL is innovative food product development. This means the IBL teaching strategy provide students with all levels of thinking in cognitive domain of Bloom’s learning taxonomy, which are remember, understand, apply, analyze, evaluate and create.

Working in group helps the students to develop teamwork skills and leadership skills. It also help the lecturers to facilitate interpersonal relationships within the classroom, so that students will have sense of community and able to communicate on a higher level with their peers; with society while conducting observation and interview to determine problems; with relevant food industry and expert of food research institutions that they visited for professional advice; with course lecturer to discuss problem identified and suggestion for problem solving; research proposal defense as well as with panel of assessor that evaluate their innovative food product. These lead to increment in the students’ communication skills.

In determining innovative food product to be developed, students search information from various online and offline resources. This process exposes the students with lifelong learning skills, information management skills and technological skills.

The interesting part about IBL is it involves real problem of society with unknown solution and requires creative thinking skills and innovation skills in solving it where Mazur (1995) called it as “an inventive problem”. The problem is not a problem with known solutions that can be solved by information found in books, technical journals or with subject matter experts. In the process of identifying problem, analyzing it and making decision to solve the problem students have to critically analyze what innovative food product to be developed that not only solving the problem but also meeting the need of the society. This requires the students to think out of the box.

The IBL of this study introduces three additional generic skills, which are research skills and innovation skills that gained through whole innovation process particularly in writing a research proposal, conducting serial of R&D, preparing final report of the innovation process. The generic skill if integrity is practices during IP certificates application.

The Challenges of IBL for Classroom Practice

The IBL teaching strategy is suitable to be applied for practical-based courses offered to final year students that are consider having maturity of thought due to having prior technical content knowledge from previous relevant courses. For instance, the IBL was applied in teaching practical-based course of Food Technology that offered in final semester of a four year first degree Living Skills Program. Before enrolling this course, the students already enrolled the Basic Food Preparation and Nutrition course in semester 1 and Food Preparation course in semester 3. These two courses provide prior theoretical knowledge about food nutrition and cooking skills that are important for the students to conduct R&D to develop innovative food product. To produce labeling and packaging for the innovated food product, the students apply knowledge and skills from the course of Computer Graphic Application that they enrolled also in previous semester. The students are also expected having variety of generic skills gained from experience been exposed to various type of student-centered learning in of previous courses learning process.

The comprehensive process in IBL teaching strategy forced the lecturers who adopt this teaching strategy to fully equipped with technical content knowledge of the course to get close involvement in.
facilitating and guiding R&D activities for innovative food product development, aware the problems faced by society related to the available food product in the market, familiar with the principles and process of innovation, analytical in determining how the innovative food product that produced through the IBL teaching strategy able to solve problem identified and meet the need of society, and having networking with food industry and food research institution for reference and professional advice.

The lecturers are also required to prepare teaching materials particularly rubrics for various types of assessment for the course and giving comprehensive explanation about the course on the first day of lecture to ensure student learning time stated in the course outline is fully utilized and all stages of every phase of the IBL process complete in week 14. These require high skills in time management for both lecturer and students.

CONCLUSION

Most students are so used to teacher-centered teaching approach whereby everything is given by the lecturers. Therefore, it is not surprise if the students failed to see the connectedness between the content lectured to the real life application. By employing IBL teaching strategy students are forced to make critical analysis and think out of the box to solve the real problem of the society. Here they learn to apply technical content of the courses been learned and all the generic skills possess. They are also experiencing learning process based on real life setting during site visit at food industries and food research institution. What they need is guidance in time management as they are undergraduate students with full hands of assignments. Well managed of structured teaching and learning process applying IBL teaching strategy conceptual model able to produce innovative students with in depth understanding of course technical content and generic skills. This IBL is a dynamic teaching strategy where it can be applied in teaching other courses like Fashion Design and Invention that having similar interest which are innovation and commercialization. It can be done by adapting the IBL conceptual model to suit to nature of the courses.

REFERENCES