

## The Outcome Based Education (OBE) at Politeknik Kota Bharu, Malaysia

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### Abstract

*This pilot study was conducted to investigate of Outcome Based Education (OBE) ability within a project-based learning (PjBL) and Competency Based Assessment (CBA) environment. Twenty-two students completed surveys on PjBL and CBA aptitude when a OBE is introduced as an education outcome at Politeknik Kota Bharu, Malaysia. Eight (8) domains of learning outcome includes; knowledge, technical skills, professionalism & ethics, social skills, communication skills, critical thinking, life long learning, entrepreneurial skills were adopted for the students to self-identify their weaknesses and strengths in completing an engineering project/product development while entering machining sections (turning & milling process). The mean values of the five items in the survey data's show a strong inclination towards outcome skills while implementation of OBE through PjBL & CBA process. The overall score value shown above eighty two percentages (82%) indicated that the students outcome based acknowledge for the three domains (Cognitive Domain; CD, Psychomotor Domain; PD, & Affective Domain; AD) of OBE output skills via PjBL & CBA are very useful in engineering fields. A replication of this study using a larger sample group size (2 groups) and examining in greater detail the two major process and instrument for measuring OBE ability, i) Project Based Learning (consisting of project development process, includes: planning/goal-setting, process monitoring/report writing) and ii) Competency Based Assessment (consisting the assessment process includes: measurement & evaluation management and control of effort to provide a better understanding of Generic Student Attributes (GSA) for engineering project/product producing).*

**Keywords:** Outcome Based Education (OBE), Project Based Learning (PjBL), and Competency Based Assessment (CBA), Project or product development, Measurement & Evaluation, Engineering student's performances.

### 1. Introduction

Outcome Based Education (OBE) is a part of student outcome based with future learning strategy that was lunched at Mechanical Department, Politeknik Kota Bharu on 16<sup>th</sup> February 2011. While OBE was lunched, the dual combination of Project Based Learning (PjBL) with Competency Based Assessment (CBA) was piloting to measure the ability of the learner (engineering students) to control interest, attitude, and effort toward a task or a goal in machining product development (Md. Baharuddin Abdul Rahman, et. al., 2011b). The OBE become new alternative education on future learning instruments such PjBL & CBA. This OBE is often associated with engineering students taking an active part in learning domains such cognitive, psychomotor, and an affective (Md Baharuddin Abdul Rahman et al., 2011a). The PjBL also match with the domains requires includes (cognitively, motivationally, and behaviorally) in their own learning activities and also controlling their own learning experiences with higher internal motivation and produce outcome based of high value of engineering students with innovative product producing (Thomas, J., 2000).

The OBE are structured with three main domains; A) Cognitive Domain (CD) that includes; i) knowledge, ii) comprehensive, iii) application, iv) analysis, v) synthesis, vi) evaluation. B) Psychomotor Domain (CD) includes; i) Imitate, ii) Manipulate, iii) Precision, iv) Articulation, v) Naturalization, and C) Affective Domain (AD) includes; i) Receiving Phenomena, ii) Responding to Phenomena, iii) Valuing, iv) Organizing Values, v) Internalizing Values. According to English version of Mechanical Workshop Practices 3: Prerequisites from J2002 Mechanical Workshop Practices 2, the objectives of learning outcome are to ensure the vertical and horizontal practice with lathe & milling machines can be use with fully various works from student was produced. Otherwise, this OBE exposes the student to fully use the lathe & milling machines for various uses (Md. Baharuddin Abdul Rahman et al., 2010). The OBE also covers the safety steps that need to be taken during (PjBL & CBA) process and its cover the operation of lathe & milling machines, practising the safety steps while in workshop, tool-edge aragement before making metric “V” thread, selecting spindle speed and feed as well as types of cutting equipment for turning works, doing various turning and milling process following correct with engineering standard procedure, and also fully understanding the process of threading and indexing with using the right methods. With PjBL & CBA process the self-regulation of students also was develop which include motivation, learning strategies and prior knowledge (Yang, H., 2001).

OBE via PjBL & CBA creates an active involvement for the learners as they have to assess situations based on their abilities (Polytechnics, Ministry of Higher Education, 2011). Pintrich (2000) describes students’ self-regulated learning activities will recover when they set their own goals based on past experiences, this surrounding environment looks matching with the OBE requirement. In engineering student and product development, OBE via PjBL & CBA recover the problems and challenges encountered in handling engineering outcome based that are normally complex and rarely straight forward to global requirements (Synteta, 2003). When OBE implemented with PjBL & CBA process, the learners also can recovering their technical & vocational skills from the first to the end. They also have learned as engineering appropriate and successful guide in product development with engineering needs (Md. Baharuddin Abdul Rahman et al., 2011b) In this aspect, Outcome Based Education (OBE) has an important place in engineering programs that significantly match with the process in PjBL & CBA (Md. Baharuddin, et. al., 2011b). PjBL is a learning method where the students reflect on their own learning experiences (Kamaruzaman et al., 2010) and learning activities are student-centered and integrated with the world of real working standard in product development.

Md. Baharuddin Abdul Rahman et al., (2009) further stated that PjBL not only enhances cooperation among learners, but also between learners and the supervisors/lecturer and between learners and others (experiences worker and engineering experts). Kamaruzaman et al, (2010) opined that team member/group need to experience for development of their motivation. Those construct will occur while discuss among themselves so that the same self development will take place among engineering students in develop their motivation while producing the product at workshop (Mat Bin Husain et al., 2010). Thus the focus of instruction is now on motivating students rather that managing classroom behavior or delivering curricula. According to Thomas (2000), projects/products development are sophisticated assignments, based on meaningful problems and incorporating problem solving, decision making, opportunities to work collaboratively and concluding with realistic product presentations and report writing. In tackling various ideas and concepts, Synteta P., (2001 & 2003) opined that PjBL enables students to develop critical skills as problem-solving and decision making skills.

This OBE paper attempts to assess the students’ perception on outcome based of two (2) products development when PjBL & CBA is introduced as instruments and process (Md. Baharuddin & Hairul Nizam, 2011c). This is to ensure that the required skills and knowledge in the workplace are fulfills by the students before they graduate (Synteta, 2001). This is also to ensure that employability skills such as problem solving, critical thinking and teamwork are part of the skill attributes that can be applied at the work place after entering OBE (PjBL & CBA) process (Md. Baharuddin Abdul Rahman, et. al., 2009). The OBE via PjBL & CBA looks recover the process of monitoring and controlling of two (2) products development that it’s can comply with the engineering standard (Md. Baharuddin Abdul Rahman et al., 2010). The standard rules occur from students output will growth up by creation of these outcome based learning (Pintrich, 2000). The self-regulation of engineering student also appears at multiple components, such as motivation, student's epistemic beliefs, meta-cognition, learning strategies, and the used of prior engineering knowledge & skills (Boekaerts, et. al., 2000).

## **2. Methods**

This study involved 22 respondents from the Mechanical Engineering Unit, which are the branch of the Mechanical Department, Politeknik Kota Bharu. Ten (10) respondents were from group (A) of SKM4A students whilst the rest were group (B) of SKM4A students from mechanical engineering program.

The two (2) product/project were briefed to complete for each respondent/students for above two groups. In this case, lecturer or expert on PjBL & CBA will describe deeply the OBE concept for product producing method & work tasks as shown in Table 1. A instrument consisting of five CBA items, based on three domains of OBE learning outcomes (Cognitive Domain :CD, Psychomotor Domain:PD & Affective Domain:AD) and five subscales of Competency Based Assessment (CBA) includes (1.Disciplines/attendance, 2.Ethics/Product Making, 3.Competence/Procedure, 4.Product Quality and 5.Tool Arrangement/Machine cleaning) was designed to collect data on the perception of students' self-achievement in weekly activities concerning by PjBL & CBA process (Table 2). A five score point scale (1 = strongly bad, 2 = low skill, 3 = good, 4 = very good, and 5 = excellent) was used to measure respondents in weekly test & evaluation with percentage (%) value. This assessment required to state the achievement (which level should match with competency (technical & vocational) skills and attitudes need). The eight (8) weeks of timeframe between PjBL process and CBA measurement & evaluation works as OBE implementation. At the end, the simple survey of input was collected to moderate level of PjBL & CBA usability.

**Table 1. Schedule of OBE implementation via PjBL & CBA process**

Schedule	Working Schedule
1 <sup>st</sup> Week	Briefing & Determination the project/product to develop: two (2) product & two (2) groups was selected.
2 <sup>nd</sup> to 5 <sup>th</sup> Week	Briefing to student groups and project supervisors on OBE concept (PjBL & CBA process) Monitoring and evaluation of Turning Process
6 <sup>th</sup> to 8 <sup>th</sup> Week	Evaluation of Milling Process & survey collection from respondent input

### 3. Results

#### 3.1 Data's percentages of turning & milling activities with OBE

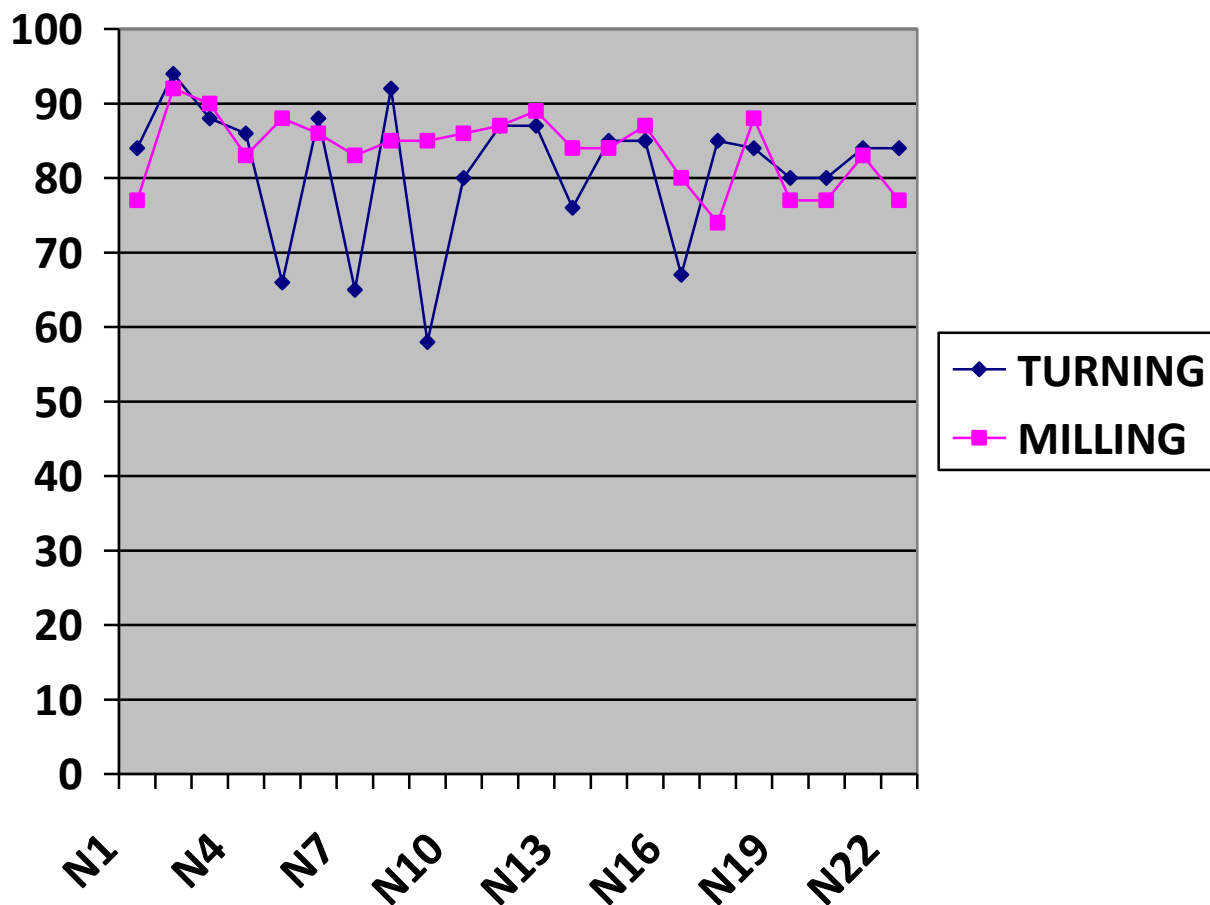
**Table 2. Data's and Score Percentages (%) of Turning & Milling Activities**

(Max:100%) The process consisting of eight (8) weeks (n = 22)

Item (n)	Respondents ID	Group (A/B)	Turning (100%)	Milling (100%)
1	04SKM08F2999	A	84	77
2	04SKM09F1003	B	94	92
3	04SKM09F1009	B	88	90
4	04SKM09F1012	B	86	83
5	04SKM09F1018	B	66	88
6	04SKM09F1021	B	88	86
7	04SKM09F1024	B	65	83
8	04SKM09F1036	B	92	85
9	04SKM09F1045	B	58	85
10	04SKM09F1054	B	80	86
11	04SKM09F1060	B	87	87
12	04SKM09F1075	B	87	89
13	04SKM09F1081	B	76	84
14	04SKM09F1090	A	85	84
15	04SKM09F1096	A	85	87
16	04SKM09F1099	A	67	80
17	04SKM09F1102	A	85	74
18	04SKM09F1108	A	84	88
19	04SKM09F1111	A	80	77
20	04SKM09F1126	A	80	77
21	04SKM09F1998	A	84	83
22	04SKM09F1999	A	84	77
Total Percentage (%)			<b>81.13</b>	<b>83.72</b>
Overall Outcome Based Percentage for Turning & Milling Process (%)			<b>82.425</b>	

Table 2 & Figure 1 shows the tabulation of the percentage result covering eight (8) weeks of OBE implementation. The minimum percentage of turning score is at 58% and the highest percentage is at 94%, the overall value of (n=22) is at highest point (81.13%). This process cover 4 weeks of running process of product development by using lathe machine to make turning works. After complete the turning process, groups should entering milling process to complete 2 products each respondent. In this area, the minimum score is at value percentage of 74%, while the highest value percentage is at score 92%, and the total value of overall milling process is at highest point (83.72%). Here, show that after two groups entering OBE via PjBL & CBA comply with the outcome based stated at highest overall value (82.425%).

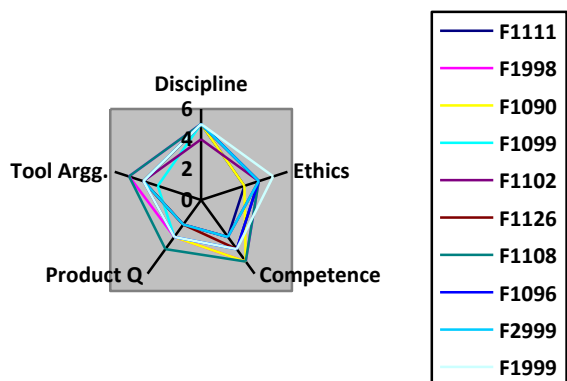
**Figure 1. Data's and Score Percentages (%) of Turning & Milling Activities**  
 (Max:100%) The process consisting of eight (8) weeks (n = 22)



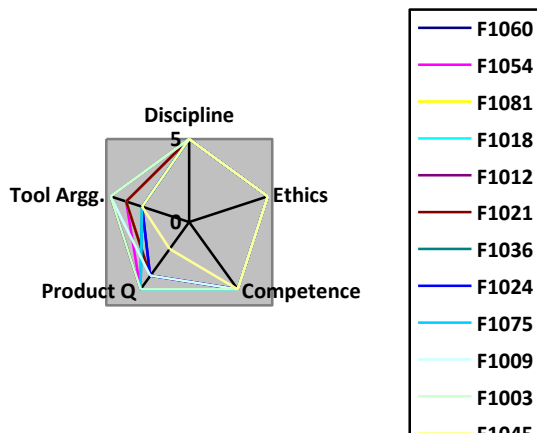
3.2 The tabulation of random data for group (A) & group (B) for 4 weeks

The data's collection just shows on overall four (4) figure of random data from first week (week no.1) to the end of process (week no.8). This data's covering turning and milling process evaluation through CBA item. The process follow the Project based learning special touch with Outcome Based Education (OBE). The full fill of engineering method and knowledge for student input was increase while the process was implemented.

3.2.1 The tabulation of turning process for the 1<sup>st</sup> week (week no.1)



**Figure 2: Distribution Score of Group A (Week 1)**



**Figure 3: Distribution Score of Group B (Week 1)**

Figure 2 shows the tabulation pentagon score for first week for turning process (Group A & B). The CBA domain result covering five (5) criteria's of OBE measurement & evaluation includes, 1)Discipline includes AD,CD, 2)Ethics includes CD,PD,AD, 3) Competence includes CD,PD,&AD, 4) Product Quality includes CD,PD,&AD, and 5) Tool Arrangement & Machine Cleaning includes CD & AD. The minimum score of minimum score is at range two (2) and the highest score is at five (5), the overall value of (n=10) respondent for group A is at range two (2) to five (5). Almost score shows average at above range four (4); very good & Five (5); Excellent. This process cover for 1 week of running process of product development by using lathe machine to make turning works. Overall five (5) criteria's are consider with OBE domains requirements (Cognitive Domain: CD, Psychomotor Domain: PD & Affective Domain: AD) while process is running.

The overall value of (n=10) respondent for group A at range two (2) was among four (4) respondents occur, and the range of five (5) was cover with fourteen (10) respondents. Almost score shows average at above range four (4); very good & Five (5); Excellent. This process cover for 1 week of running process of product development by using lathe machine to make turning works.

Figure 3 shows the tabulation pentagon score for the CBA domain result for group B. This process cover for 1 week of running process of product development by using lathe machine to make turning works. Overall five (5) criteria's are consider with OBE domains requirements (Cognitive Domain: CD, Psychomotor Domain: PD & Affective Domain: AD) while process is running. The results shows score for criteria's 1) Discipline includes AD,CD is at minimum & maximum scores are at highest point (5), and for item 2)Ethics includes CD,PD,AD, the results shows also at highest value point(5). Another score point for item 3) Competence includes CD,PD,&AD, overall marks show at highest point (5), and for the item 4) Product Quality includes CD,PD,&AD, show one at low skill of product making (2) but other at value of (4) and (5) score point. The result for item 5) Tool Arrangement & Machine Cleaning includes CD & AD are minimum score (2) and maximum score at (5). The overall value of (n=12) respondent for group B at range two (2) was among one (1) item occur, and the range of five (5) was cover with forty one (41) items. Almost score shows average at above range four (4); very good & Five (5); Excellent. This process cover for 1 week of running process of product development by using lathe machine to make turning works.

Almost score shows average at above range four (4); very good & Five (5); Excellent. From above collection data's (Figure 2 & 3), looks group B more excellent compare with performance from group A. where the almost respondent from group B full fill the OBE with PjBL & CBA process. This happen because the second group (B) entering after first group complete the process, some of them already fully understand the process by discussion with the first group. This gives more advantages to second group to more understand the process will be entering.

3.2.2 The tabulation of turning process for the last process (week no.4)

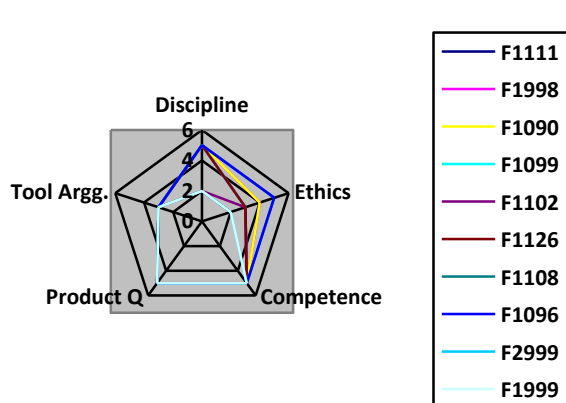


Figure 6: Distribution Score of Group A (Week 4)

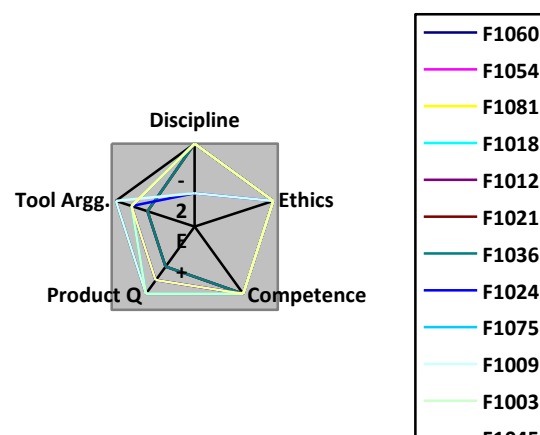


Figure 7: Distribution Score of Group B (Week 4)

Figure 6 shows the tabulation pentagon score for the CBA domain result covering five (5) criteria's of OBE measurement & evaluation for Group A, includes, 1)Discipline: includes AD,CD, 2)Ethics: includes CD,PD,AD, 3) Competence: includes CD,PD,&AD, 4) Product Quality: includes CD,PD,&AD, and 5) Tool Arrangement & Machine Cleaning includes CD & AD. The minimum score of minimum score is at range two (2) and the highest score is at five (5).

The overall value of (n=10) respondent for group A at range two (2) was among four (4) items occur, and the range of five (5) was cover with twenty-one (21) items. Almost score shows average at above range four (4); very good & Five (5); Excellent. This process cover for 1 week of running process of product development by using lathe machine to make turning works.

Figure 7 shows the tabulation pentagon score for the CBA domain result for group B. This process cover for 1 week of running process of product development by using lathe machine to make turning works. Overall five (5) criteria's are consider with OBE domains requirements (Cognitive Domain: CD, Psychomotor Domain: PD & Affective Domain: AD) while process is running. The results shows score for criteria's 1) Discipline includes AD,CD is at minimum & maximum scores are at highest point (5), and for item 2)Ethics includes CD,PD,AD, the results shows also at highest value point(5). Another score point for item 3) Competence includes CD,PD,&AD, overall marks show at highest point (5), and for the item 4) Product Quality includes CD,PD,&AD, show one at low skill of product making (2) but other at value of (4) and (5) score point. The result for item 5) Tool Arrangement & Machine Cleaning includes CD & AD are minimum score (2) and maximum score at (5).The overall value of (n=12) respondent for group B is at range two (2) to five (5). Almost score shows average at above range four (4); very good & Five (5); Excellent.

The overall value of (n=12) respondent for group B at range two (2) was zero (0) item, and the range of five (5) was cover with thirty eight (38) items. Almost score shows average at above range four (4); very good & Five (5); Excellent. This process cover for 1 week of running process of product development by using lathe machine to make turning works.

From above collection data's (Figure 6 & 7), looks group B more excellent compare with performance from group A. where the almost respondent from group B full fill the OBE with PjBL & CBA process. This happen because the second group (B) entering after first group complete the process, some of them already fully understand the process by discussion with the first group. This gives more advantages to second group to more understand the process will be entering.

3.2.3 The tabulation of milling process for the 1<sup>st</sup> week (week no.5)

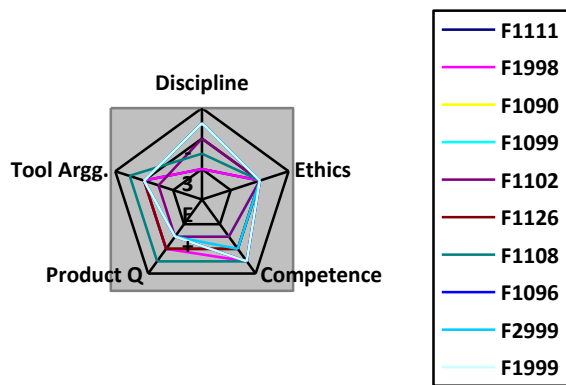


Figure 4: Distribution Score of Group A (Week 5)

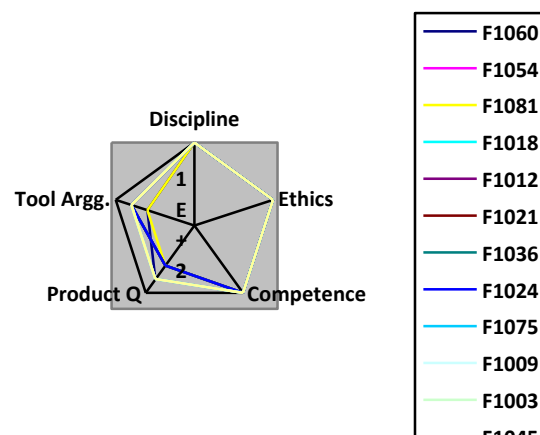


Figure 5: Distribution Score of Group B (Week 5)

Figure 4 shows the tabulation pentagon for 1<sup>st</sup> week milling process (Group A). The score for the CBA domain result covering five (5) criteria's of OBE measurement & evaluation includes, 1)Discipline includes AD,CD, 2)Ethics includes CD,PD,AD, 3) Competence includes CD,PD,&AD, 4) Product Quality includes CD,PD,&AD, and 5) Tool Arrangement & Machine Cleaning includes CD & AD. The minimum score of minimum score is at range two (2) and the highest score is at five (5), the overall value of (n=10) respondent for group A at range two (2) was among three (3) respondents occur, and the range of five (5) was cover with fourteen (14) respondents. Almost score shows average at above range four (4); very good & Five (5); Excellent. This process cover for 1 week of running process of product development by using milling machine to make milling works.

The overall value of (n=10) respondent for group A at range two (2) was among three (3) items occur, and the range of five (5) was cover with thirty (13) items. Almost score shows average at above range four (4); very good & Five (5); Excellent. This process cover for 1 week of running process of product development by using milling machine to make milling works.



Figure 5 shows the tabulation pentagon score for the CBA domain result for group B. This process cover for 1 week of running process of product development by using milling machine to make milling works. Overall five (5) criteria's are consider with OBE domains requirements (Cognitive Domain: CD, Psychomotor Domain: PD & Affective Domain: AD) while process is running. The results shows score for criteria's 1) Discipline includes AD,CD is at minimum & maximum scores are at highest point (5), and for item 2)Ethics includes CD,PD,AD, the results shows also at highest value point(5). Another score point for item 3) Competence includes CD,PD,&AD, overall marks show at highest point (5), and for the item 4) Product Quality includes CD,PD,&AD, show one at low skill of product making (2) but other at value of (4) and (5) score point. The result for item 5) Tool Arrangement & Machine Cleaning includes CD & AD are minimum score (2) and maximum score at (5).

The overall value of (n=12) respondent for group B at range two (2) was zero (0) item not occur, and the range of five (5) was cover with thirty six (36) items. Almost score shows average at above range four (4); very good & Five (5); Excellent. This process cover for 1 week of running process of product development by using milling machine to make milling works.

From above collection data's (Figure 4 & 5), looks group B more excellent compare with performance from group A. where the almost respondent from group B full fill the OBE with PjBL & CBA process. This happen because the second group (B) entering after first group complete the process, some of them already fully understand the process by discussion with the first group. This gives more advantages to second group to more understand the process will be entering.

3.2.4 The tabulation of milling process for the last process (week no.8)

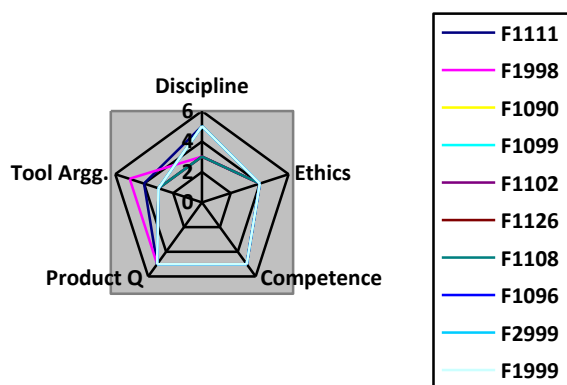


Figure 8: Distribution Score of Group A (Week 8)

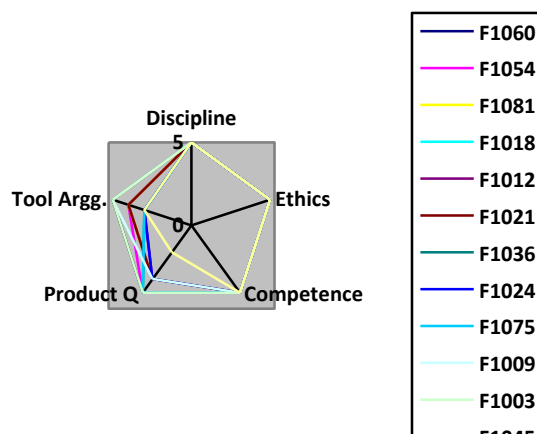


Figure 9: Distribution Score of Group B (Week 8)

Figure 8 shows the tabulation pentagon for 1<sup>st</sup> week milling process (Group A). The score for the CBA domain result covering five (5) criteria's of OBE measurement & evaluation includes, 1)Discipline includes AD,CD, 2)Ethics includes CD,PD,AD, 3) Competence includes CD,PD,&AD, 4) Product Quality includes CD,PD,&AD, and 5) Tool Arrangement & Machine Cleaning includes CD & AD. The minimum score of minimum score is at range two (2) and the highest score is at five (5), the overall value of (n=10) respondent for group A at range two (2) was among three (3) respondents occur, and the range of five (5) was cover with fourteen (14) respondents. Almost score shows average at above range four (4); very good & Five (5); Excellent. This process cover for last week of running process of product development by using milling machine to make milling works.

The overall value of (n=10) respondent for group A at range two (2) was among zero (0) item occur, and the range of five (5) was cover with forty two (42) items. Almost score shows average at above range four (4); very good & Five (5); Excellent. This process cover for last week of running process of product development by using milling machine to make milling works.

Figure 9 shows the tabulation pentagon score for the CBA domain result for group B. This process cover for last week of running process of product development by using milling machine to make milling works. Overall five (5) criteria's are consider with OBE domains requirements (Cognitive Domain: CD, Psychomotor Domain: PD & Affective Domain: AD) while process is running. The results shows score for criteria's 1) Discipline includes AD,CD is at minimum & maximum scores are at highest point (5), and for item

2) Ethics includes CD, PD, AD, the results shows also at highest value point (5). Another score point for item 3) Competence includes CD, PD, & AD, overall marks show at highest point (5), and for the item 4) Product Quality includes CD, PD, & AD, show one at low skill of product making (2) but other at value of (4) and (5) score point. The result for item 5) Tool Arrangement & Machine Cleaning includes CD & AD are minimum score (2) and maximum score at (5).

The overall value of (n=12) respondent for group B at range two (2) was zero (0) item not occur, and the range of five (5) was cover with thirty six (36) items. Almost score shows average at above range four (4); very good & Five (5); Excellent. This process cover for last week of running process of product development by using milling machine to make milling works.

From above collection data's (Figure 8 & 9), looks group A more excellent compare with performance from group B. where the almost respondent from group A can full fill the OBE with PjBL & CBA process. This happen because some of them already fully understand the process by discussion with the first group. This gives more advantages to second group to more understand the process will be entering.

### 3.3 The Response & Survey data for OBE Implementations

Week 1: Respondent attempts to assess the students' perception *whether multiple activities and procedures in the PjBL & CBA via OBE increase students' self-directed learning to achieve higher performance in carrying out tasks related to the project development*. The students' agreement that by applying the PjBL & CBA in undertaking the activities and procedures as stated in the OBE helps in achieving better results.

Week 4: Respondent attempts to assess the students' *perception on their interest in engineering drawing through the use of PjBL module and CBA*. The students indicates that the PjBL module and CBA instrument was increases their interest in engineering drawing.

Week 5: Respondent attempts to assess the students' *perception of self-regulation skills with CBA approach when working in a team (group)*. They indicate that the PjBL module and CBA helps in nurturing self-regulatory skills when working in a team (group).

Week 8: Respondent attempts to assess the students' *perception on the overall OBE increase in self-development skills after using the PjBL module & CBA evaluation*. The students' agreement that the PjBL module and CBA helps them in enforcing of self-development skills while entering project 1 & 2 development.

## 4. Discussions and Conclusions

This study shows that students' involvement in Project Based Learning (PjBL) & Competence Based Assessment (CBA) under simulated conditions but without the lecturers' on the spot monitoring it's can be improved. The success was growth while applying Outcome Based Education (OBE) instructional methods to match with PjBL & CBA implementation. Lecturers can participate in the process either as a coach, facilitator or co-learner. As suggested OBE via PjBL & CBA, a variety of Course Learning Outcomes (CLO) such as structured (observations, checklists and report portfolios) looks effectively assess for product making & engineering students. These PjBL & CBA has been designed to correspond with the unique goals of the project/product development as a part of Outcome Based Education (OBE).

The overall findings in this exploratory study suggest that the PjBL & CBA with OBE approach was beneficial in developing "outcome based of engineering students" in a "project/product" development experience. It is however recommended that this study should be replicated with a larger sample size and examine in greater detail of whole departments at Politeknik Kota Bharu & Politeknik KPTM Malaysia



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