PEMBANGUNAN DAN KEBERKESANAN MODUL PERANCAHAN BERSTRUKTUR DALAM PEMBELAJARAN BERASASKAN PROJEK TERHADAP PENGETAHUAN DAN KEMAHIRAN BAGI PROJEK MESIN LARIK PELAJAR POLITEKNIK

Oleh

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Tesis yang diserahkan untuk memenuhi keperluan bagi Ijazah Doktor Falsafah

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SENARAI SINGKATAN

ADDIE	Analisis, Reka bentuk, Pembangunan, Pelaksanaan dan Penilaian
ANCOVA	*Analysis of covariance*
ANOVA	*Analysis of variance*
Benda kerja	Keluli tahan karat berbentuk silinder yang digunakan untuk projek mesin larik
BIE	*Buck Institute for Education*
MANCOVA	*Multivariate analysis of covariance*
TPA	Temu bual Politeknik A
TPB	Temu bual Politeknik B
TPC	Temu bual Politeknik C
Tukey HSD	*Tukey Honestly Significant Difference*
PBPBP	Perancahan berstruktur dalam pembelajaran berasaskan projek
PPA	Pemerhatian Politeknik A
PPB	Pemerhatian Politeknik B
PPC	Pemerhatian Politeknik C
Projek	Projek mesin larik
STEMS	Sains, Teknologi, Kejuruteraan dan Matematik
Q-Q plot	Quantile-quantile plot
ZPD	*Zone of Proximal Development*

PEMBANGUNAN DAN KEBERKESANAN MODUL PERANCAHAN BERSTRUKTUR DALAM PEMBELAJARAN BERASASKAN PROJEK TERHADAP PENGETAHUAN DAN KEMAHIRAN BAGI PROJEK MESIN LARIK PELAJAR POLITEKNIK

ABSTRAK

Tujuan kajian adalah untuk membangun dan menilai keberkesanan modul perancahan berstruktur dalam pembelajaran berasaskan projek terhadap pengetahuan pengendalian mesin larik, kemahiran teknikal, kemahiran menyelesaikan masalah dan kemahiran mengorganisasi kerja bagi projek mesin larik pelajar politeknik. Reka bentuk kajian adalah gabungan kaedah kualitatif dan kaedah kuantitatif. Kaedah kualitatif digunakan untuk pembangunan modul perancahan berstruktur dalam pembelajaran berasaskan projek manakala kaedah kuantitatif digunakan untuk menilai keberkesanan modul perancahan berstruktur dalam pembelajaran berasaskan projek. Proses pembangunan modul perancahan berstruktur dalam pembelajaran berasaskan projek adalah menggunakan model ADDIE. Pembangunan modul perancahan berstruktur dalam pembelajaran berasaskan projek adalah berdasarkan kepada perancahan berstruktur oleh Vygotsky (1978) dan kaedah pembelajaran berasaskan projek oleh *Buck Institute for Education* (2013). Hasil pemerhatian dan maklum balas penilaian pembangunan modul perancahan berstruktur dalam pembelajaran berasaskan projek menunjukkan bahawa pelajar berupaya menghuraikan pengendalian mesin larik dengan tepat, dapat menghasilkan projek yang kemas dan mengikut spesifikasi, berupaya mencari jalan alternatif untuk menyelesaikan masalah dan berupaya merancang dan mengorganisasi kerja dengan baik. Penilaian secara statistik keberkesanan modul perancahan berstruktur dalam pembelajaran berasaskan projek terhadap pengetahuan pengendalian mesin larik, kemahiran teknikal, kemahiran menyelesaikan masalah dan kemahiran

mengorganisasi kerja adalah menggunakan kaedah *multivariate analysis of covariance* (MANCOVA). Hasil dapatan kajian menunjukkan skor min kaedah perancahan berstruktur dalam pembelajaran berasaskan projek adalah paling tinggi bagi meningkatkan pengetahuan pengendalian mesin larik, kemahiran teknikal, kemahiran menyelesaikan masalah dan kemahiran mengorganisasi kerja mengatasi skor min kaedah pembelajaran berasaskan projek dan kaedah demonstrasi. Hasil dapatan data menerusi statistik MANCOVA menunjukkan bahawa nilai signifikan adalah kurang daripada .05 ($p < .05$). Secara keseluruhannya, dapatan kajian menunjukkan modul perancahan berstruktur dalam pembelajaran berasaskan projek dapat menyokong pembelajaran pelajar dan meningkatkan pengetahuan pengendalian mesin larik, kemahiran teknikal, kemahiran menyelesaikan masalah dan kemahiran mengorganisasi kerja.

DEVELOPMENT AND EFFECTIVENESS OF STRUCTURED SCAFFOLDING IN PROJECT BASED LEARNING MODULE TOWARDS KNOWLEDGE AND SKILLS FOR POLYTECHNIC STUDENTS' LATHE MACHINE PROJECT

ABSTRACT

The purpose of this study is to develop and evaluate the effectiveness of structured scaffolding in project based learning module towards knowledge of handling lathe machine, technical skills, problem solving skill and organizing work skill for polytechnic students' lathe machine project. The design of the study is a combination of qualitative and quantitative method. Qualitative method is used for the development of structured scaffolding in this project based learning module. Meanwhile, quantitative method is used to evaluate the effectiveness of structured scaffolding in project based learning module. The process of developing structured scaffolding of this particular project based learning module is by using ADDIE model. The development of structured scaffolding in project based learning module is constructed consistent with structured scaffolding by Vygotsky (1978). Whereas project based learning method is by Buck Institute for Education (2013). The results that are gathered from observation and feedback showed that; foremost, students were able to describe precisely on how to handle the machine, other than that, they can produce a neat finishing project according to specification, in addition, students were able to find alternative solution of problems and be able to plan and organize work properly. Multivariate analysis of covariance (MANCOVA) was referred to on the matter of gathering the statistical analysis in evaluating the effectiveness of structured scaffolding in project based learning module towards the knowledge of handling lathe machine, technical skills, problem solving skill and organizing work skills. The result of the analysis showed mean score of structured scaffolding in

project based learning module is the highest on the knowledge of handling lathe machine, technical skills, problem solving skill and organizing work skill compared to mean score project based learning and demonstration method. The result of the MANCOVA analysis showed a significant value which is below .05 ($p < .05$). The overall result showed structured scaffolding in project based learning module can support student learning and improve their knowledge of handling lathe machine, technical skills, problem solving skills, and organizing work skills.

BAB 1

PENDAHULUAN

1.1 Pengenalan

Matlamat utama politeknik ditubuhkan adalah bertujuan untuk melahirkan pekerja separa mahir. Menurut Sarip (2002), politeknik merupakan institusi pengajian yang melahirkan tenaga kerja separuh mahir terutamanya di dalam bidang kejuruteraan di dalam pelbagai disiplin termasuklah bidang kejuruteraan mekanikal. Bidang Kejuruteraan Mekanikal sukar untuk difahami kerana istilah yang digunakan adalah berbentuk teknikal dan sukar digambarkan bagi seseorang yang tiada pengalaman (Salleh Tahar, 2008). Oleh itu, latihan teknikal seperti amali amatlah diperlukan bagi melatih pelajar memiliki kemahiran yang tinggi.

Bagi mempertingkatkan bilangan graduan yang berkemahiran tinggi, Transformasi Politeknik telah dilancarkan pada 25 Februari 2010 bertujuan menghasilkan modal insan yang mampu bersaing di pasaran global (Kementerian Pengajian Tinggi, 2013). Terdapat empat objektif utama dalam hala tuju Transformasi Politeknik iaitu (i) melonjakkan politeknik sebagai institusi peneraju dalam bidang teknikal dan vokasional, (ii) mengukuhkan kerelevanan dan responsif program pengajian di politeknik terhadap pembangunan ekonomi negara, (iii) menerajui bidang tujahan dan teknologi tertentu, (iv) membina reputasi antarabangsa (Jabatan Pengajian Politeknik, 2009). Hala tuju Transformasi Politeknik telah

mengukuhkan lagi peranan politeknik dalam bidang pendidikan dan latihan (Ahmad Firdaus Mohd Noor & Kamarul Azmi Jasmi A Shukor, 2015).

Kebiasaannya latihan diberikan kepada pelajar dalam bentuk amali yang dijalankan di dalam bengkel (Roslena Che Juhan, 2012). Amali dijalankan di dalam bengkel supaya pengetahuan dan kemahiran pelajar dapat dipertingkatkan sebelum melangkah ke alam pekerjaan. Pengetahuan dan kemahiran sangat berhubung kait kerana pelajar yang mempunyai pengetahuan dapat mengaplikasikannya semasa amali (Ahmad Esa, et. al, 2014).

Salah satu amali yang terdapat dalam Bidang Kejuruteraan Mekanikal di politeknik adalah amali mesin larik. Amali mesin larik melibatkan penggunaan mesin berkuasa tinggi dan alatan tangan yang tajam dan berbahaya (Nilidawati Buhari, 2008). Semasa melakukan kerja amali mesin larik, pelajar akan terdedah dengan pelbagai bahaya terutamanya semasa penyediaan bahan untuk amali, pengendalian alatan tangan yang tajam dan pengendalian mesin berkuasa tinggi. Oleh itu, pengetahuan dalam pengendalian mesin larik perlu difahami oleh pelajar supaya pelajar dapat menguasai kemahiran.

Pengetahuan pengendalian mesin larik ditakrifkan sebagai pengetahuan fakta, pengetahuan konsep, pengetahuan sesuatu prosedur dan penetapan yang betul (Anderson, Krathwohl, Airasian, Cruikshank, Mayaer, Pintrich, & Wittrock, 2001). Pelajar yang mempunyai pengetahuan pengendalian mesin larik dapat mengendalikan mesin larik dan meletakkan benda kerja di tempat yang betul (White

& Apple, 1985). Justeru, pelajar yang mempunyai pengetahuan pengendalian mesin larik dapat membina kemahiran yang diperlukan dalam amali iaitu kemahiran teknikal dan kemahiran menyelesaikan masalah serta kemahiran mengorganisasi kerja amali dengan teratur dan baik (Ruhizan Mohammad Yasin, Saemah Rahman, Kamaruzaman Jusoff, Melor Mohd Yunus, & Asnul Dahar Minghat, 2011).

Kepentingan pengetahuan pengendalian mesin larik bagi seseorang pelajar amat diperlukan supaya pelajar dapat menguasai kemahiran teknikal. Seseorang pelajar yang memiliki kemahiran teknikal boleh menunjukkan tahap kompeten dalam amali yang dijalankan (Bruck & Towns; 2009; Hair Awang, Azimi Hamzah, Rahmah Ismail, & Jegak Uli, 2004). Menurut Bruck & Towns (2009) adalah sangat penting memiliki pengetahuan dan kemahiran teknikal sebelum membuat aktiviti penerokaan maklumat untuk menyelesaikan masalah. Pelajar yang mempunyai pengetahuan dalam pengendalian mesin larik juga dapat menyelesaikan masalah yang dihadapi walau dalam situasi berlainan (Phelp, 1996) serta dapat merancang dan mengorganisasi maklumat dengan baik. Perancangan maklumat dengan baik merupakan kemahiran organisasi kerja yang diperlukan supaya jangkaan hasil yang ingin dicapai mengikut masa yang dirancangkan (Lermer, et. al., 2015; Eby & Yuser, 2013; Mergendoller, et. al., 2004).

Bagi membentuk pelajar yang berketerampilan dan berkebolehan adalah penting untuk memastikan pelajar menguasai pengetahuan pengendalian mesin larik, kemahiran teknikal, kemahiran menyelesaikan masalah dan kemahiran mengorganisasi kerja setelah amali mesin larik dijalankan. Justeru, pemilihan kaedah

pengajaran dan pembelajaran yang sesuai dengan amali dapat membantu mempertingkatkan pengetahuan pengendalian mesin larik, kemahiran teknikal, kemahiran menyelesaikan masalah dan kemahiran mengorganisasi kerja.

1.2 Latar Belakang Kajian

Pengetahuan pengendalian mesin larik amat diperlukan semasa amali (Bahale & Deshmukh, 2014; Sople, 2007). Kurangnya pengetahuan pengendalian mesin larik boleh menyebabkan beberapa masalah antaranya tidak dapat menyiapkan projek dalam masa yang ditetapkan (Bahale & Deshmukh, 2014), tidak memahami asas untuk menghasilkan projek semasa pensyarah sedang menunjukkan demonstrasi Stieger, Thelen, Bach, Richert, & Jeschke, 2011; Özdemir, 2006) dan menghadapi kesukaran untuk memahami prosedur yang ditunjukkan oleh pensyarah semasa demonstrasi (Kamilah Raden Salim, et. al., 2011).

Kesukaran memahami sesuatu prosedur yang ditunjukkan oleh pensyarah merupakan cabaran yang perlu dihadapi pelajar untuk menghasilkan sesuatu projek (Kanter, 2010). Kegagalan memahami sesuatu prosedur menunjukkan bahawa pelajar kurang berpengetahuan pengendalian mesin larik (White & Apple, 1985). Berdasarkan hasil maklum balas pelajar dan pemerhatian pensyarah yang dibuat selama tiga semester telah dirumuskan oleh Ciocanel & Mohammad H. Elahinia (2008) menunjukkan pelajar tidak boleh menerangkan prosedur atau proses penghasilan projek walaupun projek telah disiapkan. Kekurangan pengetahuan

pengendalian mesin larik boleh menyebabkan kesukaran pelajar memahami tujuan sesuatu langkah dalam prosedur dijalankan (Kamilah Radin Salim, et al., 2011). Menurut Armstrong (1980) dan Russel (1980), pelajar yang mengendalikan alatan tangan dan mesin dengan salah merupakan penyebab berlakunya kemalangan. Oleh itu, pengetahuan pengendalian mesin larik perlu difahami oleh pelajar sebelum mengendalikan mesin. Justeru, kelemahan pengetahuan pengendalian mesin larik telah membataskan pemikiran pelajar dan menyebabkan pelajar sukar untuk mengaplikasikan pengetahuan dan kaedah yang sama pada projek yang berlainan (Crouch, Fagen, Callan, & Mazur, 2004; Kelly & Finlayson, 2007).

Penguasaan kemahiran teknikal juga merupakan elemen sangat penting dalam bidang kejuruteraan kerana menunjukkan pelajar mempunyai kecekapan dan keterampilan pelajar dalam mengaplikasikan kerja teknikal selain daripada pengetahuan (Tshering Nidup & Supan Yodyingyong, 2015; Ahmad Esa, et. al., 2014). Kemahiran teknikal adalah kemahiran yang memerlukan gabungan pengetahuan khusus dan kemahiran teknikal dalam melakukan sesuatu kerja untuk mencapai suatu sasaran (Damooei, Maxey & Watkins, 2008). Pelajar yang mempunyai kemahiran teknikal dapat melakukan kerja mengikut prosedur yang ditunjukkan (Ahmad Nabil Md Nasir, Dayana Farzeeha Ali, Muhammad Khair Noordin & Mohd Safarin Nordin, 2011). Namun begitu, terdapat pelajar yang lemah dalam membuat penetapan mesin larik dengan baik (Eric & Viktor, 2012), kelemahan menghasilkan projek mengikut spesifikasi (Johnson & Yearwood, 2012) dan penghasilan projek yang kurang berkualiti (Dollar, et. al., 2005). Selain itu juga, pelajar yang kurang cekap dalam pengendalian mesin larik boleh menyebabkan

kekeliruan prosedur untuk menghasilkan projek dan menyebabkan hasil projek yang tidak mengikut spesifikasi (Sujono & Lashkari, 2007).

Oleh itu, pembelajaran berbentuk amali perlu diajar secara berasaskan pembelajaran dalam bengkel (Ghartey-Ampiah, Tufuor, & Gadzekpo, 2004) Tujuannya supaya pelajar boleh belajar menyelesaikan sesuatu masalah dalam amali yang dijalankan (Etkina & Murthy, 2005; Kanter, Smith, McKenna, Rieger, & Linsenmeier, 2003; Lokman Tahir & Azimah Arbain, 2010; Ridzwan Che' Rus & Ruhizan Mohamad, 2011). Namun begitu, penggunaan kaedah demonstrasi dalam bengkel telah menyebabkan pelajar kurang membuat penerokaan maklumat berkaitan pengetahuan asas amali yang dijalankan (Carlson & Sullivan, 1999; Gordon, 2007; Recktenwald & Edwards, 2010). Kekurangan penerokaan maklumat membataskan pengetahuan pelajar untuk menyelesaikan sesuatu permasalahan. Kelemahan pelajar dalam menyelesaikan masalah telah menyebabkan kebergantungan pelajar dalam meminta bantuan rakan dan pensyarah. Hasil kajian yang dijalankan oleh Kamilah Raden, et. al., (2011) menunjukkan seramai 60% pelajar dalam bengkel memerlukan bantuan pendidik semasa penggunaan alatan. Melalui kaedah demonstrasi juga telah menyebabkan pelajar menghadapi kesukaran untuk menyelesaikan masalah apabila masalah berbeza diberikan (Sudiman Suhaili, 2010). Hal ini adalah disebabkan pelajar sukar mencari jalan penyelesaian yang terbaik untuk menghasilkan projek (Dollar, et. al., (2005).

Kegagalan memahami sesuatu prosedur dan sukar untuk menyelesaikan masalah telah menyebabkan kesukaran pelajar untuk mengendalikan mesin larik

dengan baik (Bjurulf, 2012). Kesukaran ini dapat dibantu apabila pelajar dapat mengorganisasi kerja dengan baik dari aspek penggunaan sumber dan bahan yang diperlukan sebelum amali (Thomas,2002). Namun begitu, ketiadaan garis panduan maklumat telah menyukarkan pelajar dalam menghubungkaitkannya ke dalam projek yang hendak dihasilkan (Grantt, 2011). Temubual di antara Bennet (2009) dengan pendidik menunjukkan kelemahan kemahiran mengorganisasi kerja adalah disebabkan pelajar kekurangan strategi untuk mengurus masa, kemahiran untuk menggunakan jadual perancang dan tidak aktif mengambil catatan nota. Melalui pemerhatian yang dijalankan oleh Eleby (2009) juga menunjukkan pelajar tidak membuat catatan nota semasa sedang demonstrasi sedang ditunjukkan. Justeru, kajian ini dijalankan bagi mengenal pasti kaedah pengajaran dan pembelajaran yang sesuai digunakan dalam amali mesin larik dan meningkatkan pengetahuan pengendalian mesin larik, kemahiran teknikal, kemahiran menyelesaikan masalah dan kemahiran mengorganisasi kerja.

Pemilihan amali bengkel mesin larik di politeknik kerana proses pemotongan benda kerja menggunakan mesin larik adalah melibatkan putaran (Ojo, Ogedengbe, & Kareem, 2012; Nik Ahmad Faris Nik Abdullah, Abdul Khalid Juraimi, & Nazri Ahmad, 2012; Ibrahim Che Muda & Ramudaram, 1991). Berdasarkan kajian yang dijalankan oleh Kamaruzzaman Jaafar, Che Ghani Che Kob, & Mazlan Che Mustapha (2014) zon yang paling bahaya dalam pengendalian mesin larik adalah semasa proses pemotongan benda kerja kerana benda kerja berputar dalam kelajuan yang tinggi. Oleh itu, pelajar yang mengendalikan mesin larik tanpa mempunyai pengetahuan pengendalian mesin larik boleh mengakibatkan kemalangan yang serius

sehingga boleh mengakibatkan kematian (Noguez, & Huesca, 2008; Muhammad Syafiq Syed Mohamed, & Harizah Ideris 2012;). Justeru, kaedah pembelajaran untuk amali perlulah mempunyai aktiviti yang membolehkan pelajar membuat penerokaan maklumat supaya pelajar dapat mendalami pengetahuan pengendalian mesin larik sebelum mengendalikan mesin larik yang sebenar. Selain itu juga, hasil penerokaan maklumat boleh membantu pelajar apabila menghadapi masalah serta dapat melatih pelajar mengorganisasi kerja dengan lebih baik dan sistematik.

1.3 Penyataan Masalah

Walaupun trend pengajaran dan pembelajaran pada masa kini lebih terarah kepada berpusatkan pelajar, tetapi secara keseluruhannya pensyarah masih menggunakan kaedah demonstrasi dalam menerangkan amali (Mohd Salleh, Mohd Zaki, & Wahid Razzaly, 2008;). Menurut Stieger, Thelen, Bach, Richert, & Jeschke (2011) kaedah demonstrasi menjadikan pelajar bertindak pasif dan menganggap amali tidak memerlukan pelajar berfikir kerana mereka hanya perlu mengikut sahaja langkah kerja yang ditunjukkan oleh pensyarah semasa amali .

Kesannya, pelajar kurang pengetahuan pengendalian mesin larik dan kemahiran yang diperlukan semasa amali (Helsing, Lewis, & Warga, 2013). Kekurangan pengetahuan pengendalian mesin larik untuk menghasilkan projek menyebabkan pelajar membuat penetapan mesin larik yang salah (Eric & Vicktor, 2012) dan menghasilkan projek tidak mengikut spesifikasi (Johnson & Yearwood,

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