LAPORAN AKHIR TAHUN

PENELITIAN BERBASIS KOMPETENSI

ASPEK-ASPEK PENGEMBANGAN

MODEL PEMBELAJARAN BERBASIS LEAN

UNTUK MENINGKATKAN WORK *SKILLS* SISWA KEJURUAN

Tahun Ke-1 dari rencana 3 tahun

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Judul Penelitian   : Aspek-Aspek Pengembangan Model Pembelajaran Berbasis Lean Untuk Meningkatkan Work Skills Siswa Kejuruan

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RINGKASAN

Hasil lulusan pendidikan kejuruan diindikasikan memiliki kompetensi sangat rendah dan tidak dapat memenuhi pangsa kerja yang mengakibatkan banyaknya pengangguran. Sementara tingkat serapan tenaga kerja masih rendah. Berdasarkan data BPS 2017, serapan tenaga kerja secara nasional untuk tingkat pendidikan SMK terdapat 10.87%, lebih rendah dibandingkan pendidikan SMA sebesar 20.52%, untuk SMP sebesar 18,16%, bahkan untuk tingkatan SD jauh lebih besar yaitu 42.23%., sedangkan tingkat pengangguran secara khusus pada tingkat Provinsi Kepulauan Riau pada tahun 2017 menyumbang sebesar 6.44%. Sesuai dengan bidang kerja permesinan jumlah tenaga kerja yang terserap pada bidang industri manufacture dan permesinan sebesar 41,20%, dimana sebagian besar industri tersebut terletak di pulau Batam. Kesenjangan tentang keahlian sesuai dengan taraf pendidikan dalam dunia kerja sangat jelas terlihat antara tenaga kerja lulusan SD, SMP, SMA dan SMK. indikasi ini menunjukkan bahwa siswa lulusan SMK belum memiliki tingkat kemampuan dan peluang yang lebih baik untuk mendapatkan pekerjaan yang layak. Untuk mengurangi pengangguran dan kesenjangan pada keterserapan tenaga kerja dengan bidang pendidikan SMK, kami menawarkan alternatif solusi dengan mengintegrasikan proses pembelajaran dalam sekolah kejuruan (SMK) dengan pembelajaran berbasis Lean dengan luaran utama yaitu peningkatan work skills (*hard skills dan soft skills*) siswa Sekolah Menengah Kejuruan. Konsep yang ditawarkan adalah menjadikan siswa kejuruan yang memiliki work skills sesuai dengan kebutuhan industri yang mampu menganalisis, memberi solusi dan memecahkan masalah pada bidang kompetensi dan keahliannya. Tujuan penelitian ini adalah menghasilkan model pembelajaran berbasis Lean untuk meningkatkan work skills siswa kejuruan terutama jurusan Teknik Mesin SMK serta menghasilkan bahan pembelajaran sebagai panduan proses belajar.

Jenis penelitian ini secara keseluruhan adalah jenis penelitian pengembangan dengan populasi penelitian siswa kejuruan di wilayah Kepulauan Riau pada jurusan Teknik Mesin. Sampel penelitian adalah siswa kejuruan pada jurusan Teknik Mesin di Kepulauan Riau. Pengembangan dilakukan dengan menggunakan desain pengembangan Borg dan Gall. Penelitian tahun ke-1 bertujuan mengetahui kebutuhan work skills yang terdiri dari soft skils dan hard skills untuk siswa pendidikan kejuruan teknik mesin, dengan jenis penelitian discriptive kuantitatif menggunakan analisis pendekatan Dacum. Sample penelitian terdiri dari 100 responden, yang terdiri dari praktisi industri, praktisi pendidikan kejuruan, pakar pendidikan kejuruan yang relevan pada teknik mesin. Berdasarkan hasil analisis terdapat 27 item soft skills dan 67 item hard skills yang direkomendasikan untuk works skills siswa kejuruan teknik mesin. Berdasarkan hasil analisis, temuan tersebut akan digunakan sebagai referensi untuk mengembangkan model pembelajaran berbasis lean untuk meningkatkan work skills siswa kejuruan teknik mesin.

Keywords: Research and Development *Need and analysis, Work Skills, soft skills, hard skills*

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BAB 1. PENDAHULUAN

A. Latar Belakang

Pendidikan kejuruan merupakan program pendidikan yang diselenggarakan secara langsung dan dikaitkan dengan persiapan individu dalam menghadapi pekerjaan yang akan datang baik yang mendapatkan penghasilan tetap atau tidak tetap, sebagai persiapan tambahan individu dalam mengembangkan karir yang dibutuhkan, selain jenjang pendidikan sarjana muda atau pendidikan kejuruan yang sederajat.(Calhoun dan Finch.1982:60). Lulusan SMK harus diarahkan sebagai tamatan yang siap kerja, cerdas, memiliki keunggulan kompetitif, komparatif serta berkarakter kuat sebagai pekerja yang profesional, maka penguasaan hard skills dan *soft skills* harus dikuasai dengan baik untuk menjadi lulusan yang unggul dan bermutu dalam menghadapi persaingan dunia kerja. Galuh Setya (*Career News*. Mei 2013) "*soft skills* adalah faktor yang menentukan dalam proses rekrutmen".

Undang-undang No 20 tahun 2003, pasal 15, bahwa pendidikan kejuruan merupakan pendidikan yang mempersiapkan peserta didik terutama untuk bekerja dalam bidang tertentu. Dengan adanya sekolah kejuruan, tenaga kerja dapat tersedia dengan baik, namun demikian tingkat serapan ketenaga kerjaan dari lulusan SMK tidak dapat terimbangi oleh kondisi *hard skills* dan *soft skills* yang dimiliki oleh karyawan lulusan SMK, indikasi masalah paling yang sering terjadi pada industri, diakibatkan kurangnya *soft skills* dan *hard skills* karyawan sesuai dengan kompetensinya.

Berdasarkan data yang disampaikan BPS per Agustus 2014 terdapat angka pengangguran sebesar 7,2 juta orang dengan rincian, 18 persen tamatan SLTA Kejuruan (1.3 juta), dimana mengalami peningkatan dari 11,9 persen dari bulan Februari 2014. Sedangkan pengangguran yang lain 2,7 persen tamatan Diploma (193 ribu) dan 6,8 persen tamatan Sarjana (495 ribu). Perubahan data berdasarkan BPS 2017 menyatakan, serapan tenaga kerja secara nasional untuk tingkat pendidikan SMK terdapat 10.87%, lebih rendah dibandingkan pendidikan SMA sebesar 20.52%, untuk SMP sebesar 18,16%, namun ternyata untuk tingkatan SD jauh lebih besar yaitu 42.23%. Artinya banyak terdapat tingkat pengangguran yang tercatat, secara mencolok adalah perbedaan serapan ketenaga kerjaan antara lulusan SMA, SMK, SMP dan SD. Dijelaskan lebih lanjut tingkat pengangguran secara khusus pada Provinsi Kepulauan Riau pada tahun 2017 menyumbang sebesar 6.44%. Sesuai dengan bidang kerja permesinan jumlah tenaga kerja yang terserap pada bidang industri manufacture dan

permesinan sebesar 41,20%, dimana sebagian besar industri tersebut terletak di pulau Batam. Hal ini merupakan masalah yang sangat penting untuk diatsi atau dicarikan solusinya, demikian halnya proses pembelajaran SMK yang ada Kepulauan Riau, terutama di Batam, belum menyentuh aspek *technical* dan *soft skills* secara komprehensif dan efisien, sehingga tamatan yang dihasilkan belum memiliki keahlian *hard skills* dan *soft skills* yang dibutuhkan industri. Hakekatnya dalam mengembangkan pembelajaran *hard skills* dan *soft skills* harus secara langsung terintegrasi dengan proses kerja sehingga akan terbangun pengalaman *hard skills* dan *soft skills* pada proses pembelajaran. Lubis (2010), *"Vocational education is education for work. In order to reach this aim, instructional strategies used should be directed to all requirements needed in the work place. The students should learn the knowledge, skills, attitudes, and values which are important in doing a certain job in such a way as they apply them in the real work setting"*. Siswa harus dibekali dengan pengetahuan, ketrampilan, sikap dan nilai-nilai yang diperlukan dalam lingkungan kerja yang sesungguhnya. Prossers (1949) pembelajaran yang terintegrasi dengan dunia kerja, memberikan pengalaman kepada siswa dan menjembatani antara pendidikan sekolah dengan dunia kerja profesional, model ini memberikan kesempatan untuk menggabungkan kemampuan teoritis dalam pendidikan dengan penerapan langsung dalam dunia kerja.

Diperlukan sebuah upaya untuk mengurangi pengangguran yang diindikasikan oleh kurangnya kemampuan *hard skills* dan *soft skills* yang tidak setara dengan dunia industri. Kinerja yang efektif dan efisien dalam dunia industri tidak hanya ditentukan oleh *technical skills* atau *hard skills*, tetapi *soft skills* juga memberikan dukungan yang besar. *Research on predicting the future career success of students supports employers' opinions that some soft skillss are a better predictor of a dult success (salaries, graduation rates, home ownership) than technical skills (Pritchard, 2013).* *Soft skills* mempunyai peran yang sangat dominan dalam mendukung pekerjaan dan perkembangan karir seseorang. *Soft skills* merupakan kompetensi yang sangat penting yang harus dimiliki oleh tenaga kerja dalam menghadapi dunia kerja dan pengembangan karirnya."*Appropriate soft skills play an important role in a successful career as well as during social interactions in the society. These skills are also highly sought after by employers recruiting fresh graduates"* (Majid dan Liming, 2012). Pembelajaran yang mengintegrasikan dengan dunia kerja secara nyata memberikan manfaat yang sangat besar dalam kemahiran kompetensi kejuruan. Sousa (2011:39) *"Recognized that*

intelligence and creativity are separate abilities that are not genetically fixed, and that both can be modified by the environment and schooling". Dengan demikian diperlukan kemampuan yang berimbang antara *hard skills* dan *soft skills* untuk dapat meningkatkan kompetensi siswa SMK.

BAB 2. TINJAUAN PUSTAKA

A. Pembelajaran Berbasis LEAN

Model Pembelajaran Berbasis LEAN. Model pembelajaran merupakan rancangan yang tersusun dan terstruktur dalam urutan logis dan sistematis yang digunakan sebagai pedoman dalam melakukan suatu kegiatan pembelajaran. Prawiradilaga (2008: 33) mengistilahkan model sebagai prosedur kerja yang teratur dan sistematis yang mengandung pemikiran, uraian atau penjelasan suatu konsep. Wina Sanjaya (2006: 129) mengartikan pembelajaran sebagai dasar proses penambahan informasi dan kemampuan baru. Berdasarkan ulasan yang disampaikan diatas maka dapat ditarik benang merah bahwa yang dimaksud dengan model pembelajaran adalah panduan atau prosedur yang terstruktur yang digunakan dalam proses pembelajaran untuk mencapai tujuan pembelajaran yang efektif, praktis dan efisien yang menjembatani peserta didik dalam proses belajar secara aktif dan interaktif agar dapat mencapai kemampuan optimal sesuai dengan kompetensinya. Model pembelajaran merupakan prosedur yang diciptakan untuk terus dinamis menyesuaikan dengan perkembangan jaman dan teknologi, perubahan sosial ekonomi dan masyarakat, sehingga dapat diartikan bahwa model pembelajaran akan selalu mengalami perbaikan dan perubahan untuk mencapai efisien dan efektifitas pembelajaran.

Perkembangan dinamis dalam masyarakat turut andil dalam merubah proses pembelajaran, diharapkan output pendidikan kejuruan juga mampu memenuhi kebutuhan dalam pangsa kerja masyarakat. Perubahan dinamis dalam dunia industri sangat perlu dicermati sehingga diperlukan proses pembelajaran yang menyamai standar industri. Prosser's Sixteen Theorems on Vocational Education (1949) dalil kedua menyatakan *"Effective vocational training can only be given where the training jobs are carried on in the same way with the same operations, the same toolsand the same machines as in the occupation itselfi"*. Pendidikana kejuruan dalam upaya menghasilkan tenaga kerja yang kompeten harus dapat

memenuhi standar tersebut. Mengacu pada dalil Prossers, pembelajaran yang tepat sesuai dengan kebutuhannya adalah mengintegrasikan pembelajaran dengan dunia industri. Prinsip utama yang dijalankan dalam perindustrian adalah mencapai efisiensi dan produktifitas tinggi dengan mengaplikasikan *Lean Manufacturing*. William (2001). *The Five Primary Elements for lean manufacturing are (1) Manufacturing Flow, (2) Organization, (3) Process Control, (4) Metrics, and (5) Logistics.* Lean manufacturing merupakan konsep dan prinsip yang digunakan dalam perusahaan dan proses produksi untuk memaksimalkan pekerjaan untuk mencapai keuntungan yang maksimal dengan mengaplikasikan kelima prinsip tersebut tanpa terpisah. William (2001) *"Lean manufacturing, is primarily focused on designing a robust production operation that is responsive, flexible, predictable, and consistent.* Lonnie (2010) *It is called Lean because, in the end, the process can run:Using less material, Requiring less investment, Using less inventory, Consuming less space and, Using less people.*

Work Skills. *Work Skills,* merupakan kemampuan yang perlu dimiliki oleh individu dalam proses pekerjaan yang terdiri dari hard skills dan soft skills. *Hard skills* dalam pendidikan kejuruan merupakan salah satu diantara *skills* yang harus dimiliki oleh siswa untuk mencapai kompetensinya. Hartanto. (2017), *"There are some skills that are specific to needs in industry and manufacturing, the skills need will be very important as defense to face of the information development and the environment rapidly".* Hard skills merupakan kemampuan yang terkait dengan sesuatu yang dapat dipelajari dalam pendidikan yang bertujuan untuk meningkatkan kemampuan intelektual. Coates (2006). *hard skills" are technical or administrative procedures related to an organization's core business.* Mazoota (2015) *"Hard skills are skills where the rules stay the same regardless of which company, circumstance or people you work with."*

Soft skills merupakan kemampuan yang dimiliki oleh setiap individu, tidak dapat dilihat, namun *soft skills* merupakan kemampuan yang sangat berperan besar dalam kehidupan seseorang, dimana sangat menunjang kemampuan, karir dan pekerjaan seseorang (Hartanto.2017). Robles (2012)."*Soft skills are character traits, attitudes, and behaviors— rather than technical aptitude or knowledge. Soft skills are the intangible, nontechnical, personality-specific skills that determine one's strengths as a leader, facilitator, mediator, and negotiator".* Coatest (2006),"*They have to do with how people relate to each other:*

communicating, listening, engaging in dialogue, giving feedback, cooperating as a team member, solving problems, contributing inconducted some first-rate training and was well meetings and resolving conflict".. Chaturvedi (2011:5) " *the impact which the soft skills training could give in enhancing the output of hard skills". "Soft skills play a crucial role in making students employable as it enables them to be flexible, positive to change, handle ever-increasing expectations of employers and to stay globally competitive"*.(Rani.2010:4). Pada masa yang akan datang struktur pekerjaan di dunia industri akan menghilangkan lebih banyak pekerjaan *non skills*, namun akan digantikan dengan pekerjaan yang membutuhkan ketrampilan, keahlian yang sangat baik pada bidang membaca, perhitungan, komunikasi, dan pemecahan masalah atau keterampilan penalaran.

Work Skills mengacu kepada kebutuhan industri dilakukan dengan analisis kebutuhan menggunakan pendekatan Dacum, Pendekatan ini digunakan pada berbagai metode untuk mengetahui ketepatan penggunaan pembelajaran dan pemetaan kompetensi berdasarkan kepada praktisi atau pakar yang telah melakukan pekerjaan dan kegiatan sesuai dengan bidang keahlian (Hartanto.2017, Norton.2004). Hasil dari analisis akan menunjukkan kesenjangan antara proses belajar mengajar di sekolah kejuruan dengan proses pekerjaan dan kegiatan yang ada di industri. Kesenjangan yang ditemukan menjadi sebuah dasar pengembangan untuk meningkatkan proses pembelajaran melalui model pembelajaran Lean.

B. Konsep Penelitian
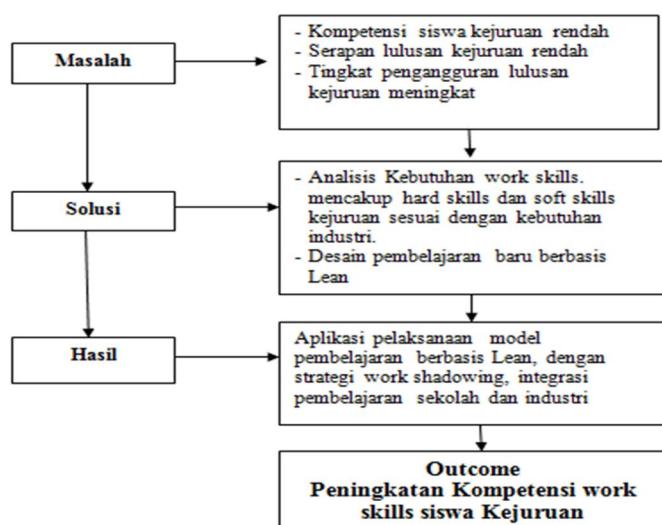
Gambar 1. Kerangka Konsep Keseluruhan Penelitian

BAB 3. TUJUAN DAN MANFAAT PENELITIAN

A. Tujuan Penelitian

Tujuan penelitian ditetapkan berdasarkan pada roadmap penelitian dalam jangka waktu yang telah ditentukan. Penelitian pada tahun pertama mengacu pada tujuan penelitian no.1 dan seterusnya. Adapun tujuan penelitian tahun pertama sesuai dengan yang diajukan pada Ristek Dikti Adalah:

1. Mengetahui cakupan kebutuhan soft skills dan hard skills untuk siswa SMK dalam meningkatkan kompetensi work skills pada jurusan Teknik Mesin.

B. Manfaat Penelitian

Pendidikan kejuruan bertujuan menghasilkan tenaga kerja yang mempunyai kompetensi sesuai bidangnya, namun pada pada kenyataanya kompetensi atau skills yang dimiliki sangat rendah dan tidak dapat memenuhi pangsa kerja yang mengakibatkan banyaknya pengangguran. Untuk mengatasi pengangguran dan meningkatkan kompetensi siswa SMK, perlu adanya alternatif solusi dengan mengintegrasikan proses pembelajaran berbasis Lean dengan outcome peningkatan *hard skills* dan *soft skills* atau secara keseluruhan disebut dengan work skills, siswa Sekolah Menengah Kejuruan khususnya pada Jurusan Teknik Mesin. Konsep yang ditawarkan adalah menjadikan siswa menengah kejuruan yang memiliki *hard skills* dan *soft skills* sesuai dengan kebutuhan industri yang mampu menganalisis, memberi solusi dan memecahkan masalah pada bidang teknik mesin. Adapun manfaat penelitian untuk tahun pertama adalah:

1. Bagi Guru sebagai salah satu alternatif model pembelajaran inovatif yang dapat diterapkan dalam proses pembelajaran di Sekolah Menengah kejuruan.

2. Bagi peneliti sebagai bahan masukan untuk menginspirasi dan inovasi agar terciptanya ide-ide baru yang lebih inovatif dalam pengembangan model pembelajaran

3. Bagi Dinas terkait sebagai masukan pengembangan bidang pendidikan dan ilmu pendidikan khususnya pengembangan pembelajaran inovatif.

BAB 4. METODE PENELITIAN

A. Jenis Penelitian

Berdasarkan latar belakang masalah dan tujuan penelitian yang telah disebutkan untuk keseluruhan penelitian ini, secara garis besar adalah penelitian pengembangan atau *Research*

and development (R&D). Gall dan Borg (1983:772) : *R&D is a process used to develop and validate educational products.* Dalam penelitian ini melakukan pengembangan dan menghasilkan produk pembelajaran yang akan diterapkan kepada siswa sebagai pengguna.

B. Prosedur Pengembangan Model Pembelajaran Berbasis LEAN

1. Analisis Kebutuhan

Analisis ini mencakup analisis sarana dan prasarana pembelajaran, kebutuhan siswa, karakteristik siswa, menganalisis kemampuan pendidik dan kendala yang dihadapi selama pembelajaran untuk beberapa aspek *soft skills* dan *hard skills* untuk menuju pada work skills pada bidang industri.

2. Desain

Pada tahap ini hal pertama yang dilakukan adalah menetapkan konsep-konsep utama dari nilai *soft skills* dan *hard skills* yang akan di integrasikan pada materi pembelajaran dan menetapkan mata pelajaran ayang akan dijadikan subjek penelitian. Kemudian melihat kondisi awal siswa program studi Teknik Mesin di Kepulauan Riau.

3. Evaluasi

Pengembangan pada tahap evaluasi dilakukan uji coba yang dilakukan oleh pakar dan siswa dengan mengisi lembar observasi. Hasil obervasi tersebut diperoleh saran dari pakar maupun dari siswa. Validitas uji coba akan dilakukan oleh pakar, sedangkan pelaksanaan uji coba untuk siswa akan dilakukan tiga tahap, yaitu uji kelompok kecil, uji terbatas dan uji kelompok besar untuk melihat kepraktisan dan keefektifan produk yang dibuat dan dikembangkan. Tanggapan mengenai kesesuaian produk akan diperoleh setelah siswa memberikan tanggapannya masing-masing pada lembar kertas yang diberikan, berdasarkan saran dan tanggapan itulah produk akan diperbaiki.

C. Subjek Penelitian

Subjek dalam penelitian ini terdapat dalam beberapa kegiatan penelitian. Analisis kebutuhan berdasarkan pada masukan dari praktisi industri, guru SMK pada bidang relevan, siswa yang belajar pada jurusan yang relevan yang terdiri dari 100 responden. Untuk uji praktikalitas dan efektifitas dengan menggunakan siswa yang sedang belajar mata pelajaran Teknik Mesin SMK di Kepulauan Riau pada tahun ajaran 2018/2019, 2019/2020 dan

2020/2021. yang dilaksanakan disekolah ataupun di industri yang sedang melaksanakan praktek kerja industri.
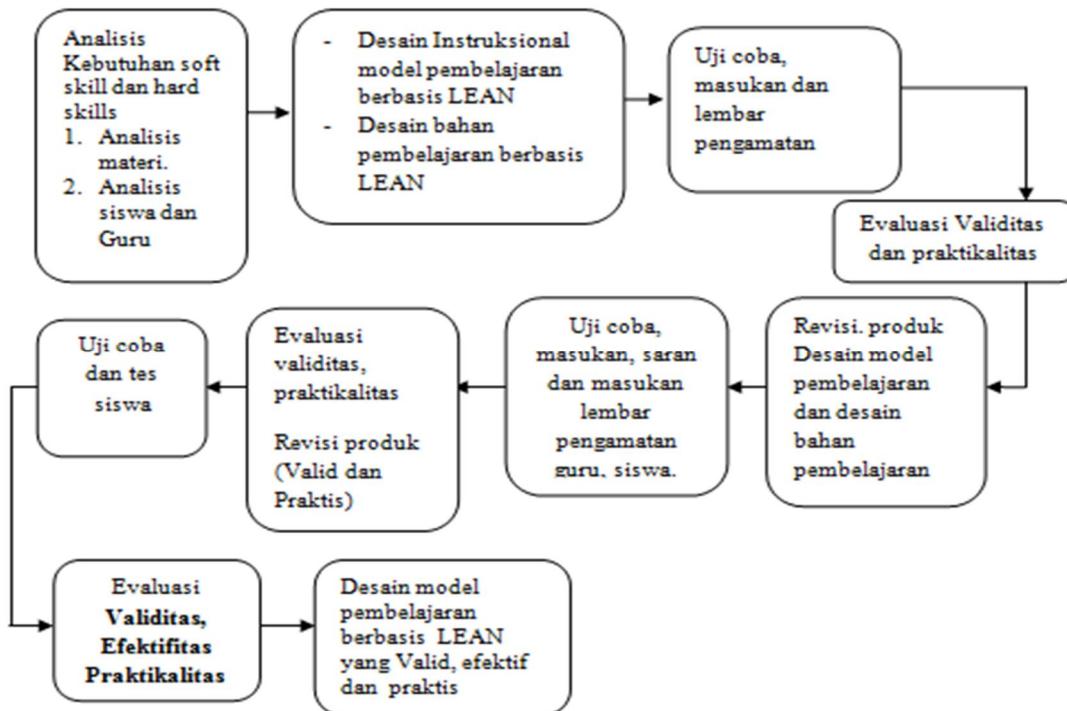
Gambar 2. Tahap pengembangan Model Pembelajaran berbasis LEAN

(Adaptasi dari Borg dan Gall. 1983)

BAB 5. HASIL DAN LUARAN YANG DICAPAI

A. Hasil Penelitian tahun I

Berdasarkan hasil penelitian tahun pertama, dilakukan analisis kebutuhan dengan penelitian lapangan menggunakan instrumen analisis kebutuhan untuk soft skills dan hard skills untuk siswa jurusan teknik mesin SMK, sebagai dasar dari pengembangan model pembelajaran berbasis Lean untuk siswa kejuruan teknik mesin SMK. Hasil analisis kebutuhan untuk soft skills dan hard skills pada siswa kejuruan teknik mesin selanjutnya di sebut sebagai **Work Skills Factor** pada jurusan teknik mesin. Adapun hasil analisis kebutuhan tersebut adalah:

1. **Deskripsi data penelitian analisis kebutuhan soft skills siswa kejuruan teknik mesin.**

Hasil analisis kebutuhan *soft skills*, dikategorikan menjadi dua bagian yaitu *soft skills* umum yang dapat digunakan dalam bidang kerja perusahaan dan *soft skills* spesifik pada

bidang permesinan. Hasil analisis kebutuhan *soft skills* dengan menggunakan kriteria keputusan respon pada analisis kebutuhan dengan melihat respon dengan kategori SP (sangat penting) dan P (penting).

   Soft skills **kategori umum** yang digunakan dalam perusahaan dan menunjang pekerjaan pemesinan terdiri dari : **1**). Menunjukkan kemauan dalam mengembangkan karir, dengan persentase kategori sangat penting dan penting sebesar 68% dan 32%, **2).** Menunjukkan etika berkomunikasi pada tempat bekerja, 80% dan 20%, **3**). Menunjukkan hubungan antar pribadi yang baik dalam pekerjaan, 76% dan 24%, **4).** Menunjukkan kerjasama yang baik dalam pekerjaan, 92% dan 8%, **5**). Menunjukkan etos kerja yang tinggi dalam pekerjaan, 78% dan 20%, **6**). Menampilkan tindakan memecahkan masalah sesuai dengan aturan pekerjaan, 56% dan 42%, **7**). Mempertahankan kehadiran tepat waktu, 70% dan 30%, **8).** Menunjukkan inisiatif tinggi dalam pekerjaan, 56% dan 42%, **9).** Menunjukkan sikap jujur dalam bekerja, 82% dan 18%, **10**). Mematuhi semua peraturan dalam pekerjaan, 64% dan 34%, **11**). Menunjukkan sikap bertanggung jawab dalam setiap pekerjaan yang dilakukan, 84% dan 16%, **12**). Menunjukkan adaptasi yang baik dalam bekerja, 50% dan 46%.

   Soft skills **kategori khusus** untuk pekerjaan pemesinan yang dibutuhkan dalam dunia kerja sesuai dengan hasil analisis adalah :**13).** Berusaha mematuhi proses kerja sesuai dengan rencana dan gambar desain produksi, 68% dan 26%, **14).** Berusaha mematuhi kuota produksi yang ditentukan, 56% dan 38%, **15).** Menunjukkan sikap mendukung ,merawat dan mempertahankan keberhasilan instansi/perusahaan, 66% dan 30%, **16).** Termotivasi untuk mengikuti pelatihan lanjutan dan pembelajaran proses kerja, 58% dan 42%, **17).** Menunjukkan perencanaan dan operasional sesuai sepesifikasi produk berdasarkan instruksi kerja, 46% dan 50%, **18).** Selalu mendemontrasikan Warming up mesin sebelum operasional, 44% dan 52%, **19).** Menunjukkan kesiapan peralatan sebelum operasional, 62% dan 36%, **20).** Menunjukkan pengecekan unit mesin di awal operasional, 64% dan 36%, **21).** Melakukan setting mesin sesuai spesifikasi produk, 74% dan 26%, **22).** Mendemostrasikan material handling yang benar, 52% dan 44%, **23).** Mendemonstrasikan kesehatan dan keselamatan kerja pada setiap proses kerja mesin, 80% dan 18%, **24).**Menunjukkan kehati-hatian dalam mengoperasikan mesin, 74% dan 26%, **25).** Menunjukkan pemeliharaan dan perawatan mesin, 66% dan 34%, **26).** Mendemonstrasikan pengecekan hasil kerja sesuai standar kualitas

produksi, 62% dan 34%, **27).** Mendemonstrasikan mematikan mesin secara berurutan sesuai prosedur, 78% dan 20%.

2. Deskripsi data penelitian analisis kebutuhan Hard skills siswa kejuruan teknik mesin.

Berdasarkan hasil penelitian, hard skills untuk siswa kejuruan teknik mesin terdiri dari 67 point yang direkomendasikan dengan kebutuhan pembelajaran siswa jurusan teknik mesin. Adapun hard skills tersebut adalah:

1). Memahami dan menerapkan aturan teknik gambar mesin dan tanda pengerjaannya.54% dan 46 %. **2)**. Memahami dan mendemonstrasikan konsep dasar, fungsi perintah Computer Aided Design (CAD).46% dan 54%. **3)**. Memahami dan menyajikan pembuatan gambar detail, etiket gambar komponen mesin dengan CAD sesuai standar ISO 42% dan 56%. **4)**. Menganalisis dan menunjukkan pembuatan gambar detail komponen mesin (gambar proyeksi, gambar potongan dan pemberian ukuran, toleransi, suaian, tanda pengerjaan dan nilai kekasaran permukaan) dengan CAD 2D/3D. 48% dan 50%, **5)**. Memahami dan mengidentifikasi bagian-bagian mesin bubut berdasarkan jenis dan fungsinya. 48% dan 46% **6)**. Memahami, menganalisa dan mengidentifikasi kesesuaian alat potong mesin bubut.24% dan 70%, **7)**. Menerapkan dan menyajikan prosedur teknik membubut eksentrik, 22% dan 78%, **8)**. Mengevaluasi dan menentukan prosedur teknik membubut eksentrik 34% dan 60%, **9)**. Menganalisis dan menentukan pembuatan benda kerja menggunakan face plate, 20% dan 74%, **10)**. Menerapkan dan membuat prosedur teknik pembuatan benda kerja rakitan, dengan menggunakan berbagai cara, 30% dan 52%, **11)**. Memahami dan mengidentifikasi bagian-bagian mesin frais berdasarkan jenis dan fungsinya, 36% dan 56%., **12)**. Menganalisis dan mengidentifikasi penggunaan alat potong pada mesin frais, 28% dan 64%, **13)**. Mengevaluasi dan menggunakan parameter pemotongan mesin frais untuk berbagai jenis pekerjaan, 22% dan 62 %. **14)**. Menerapkan dan menggunakan standar operasional prosedur teknik pengefraisan pada semua bentuk benda kerja, 38% dan 58%. **15)**. Memahami dan mengidentifikasi mesin gerinda untuk berbagai jenis pekerjaan, 34% dan 56%, **16)**. Menerapkan dan mengoperasikan teknik pemesinan gerinda datar untuk berbagai jenis pekerjaan, 14% dan 68%, **17)**. Memilih dan menggunakan parameter pemotongan mesin gerinda untuk berbagai jenis pekerjaan, 14% dan 58%. **18)**. Mengevaluasi dan menggunakan teknik pemesinan gerinda pada berbagai jenis pekerjaan, 10% dan 78%. **19)**. Memahami dan mengidentifikasi parameter dan bagian-bagian pada mesin bubut dan frais CNC, 28% dan

68%. **20)**. Menerapkan dan mengoperasikan semua prosedur pada setiap pekerjaan pemesinan bubut dan frais CNC, 24% dan 72%. **21)**. Mengevaluasi dan memperbaiki kegagalan hasil pekerjaan mesin bubut dan frais CNC, 32% dan 62%, **22)**. Menganalisis dan mendemonstrasikan Computer Aided Manufacturing (CAM) 2D dan 3D untuk proses Milling, lathe facing dan driling, 30% dan 58%, **23)**. Mengevaluasi penggunaan program CAM melalui proses simulasi pada semua pekerjaan pemesinan, 28% dan 58%. **24)**. Memahami konsep dan mematuhi pemeliharaan sesuai buku manual/operasi, 48% dan 46%. **25)**. Memahami jenis, fungsi dan mendemonstrasikan alat pemeliharaan utama mekanik dan elektrik, 30% dan 68%. **26)**. Memahami dan mengklasifikasi jenis gangguan komponen mekanik mesin industri, 42% dan 52%, **27)**. Menganalisis kerusakan dan melakukan perbaikan ringan komponen mekanik mesin industri, 30% dan 64%. **28)**. Menerapkan dan melakukan prosedur pemeliharaan/ perbaikan mekanik mesin industri (kompresor, pompa, motor bensin), 46% dan 46%. **29)**. Menganalisis dan menunjukkan pemeliharaan pencegahan (preventif maintenance) pada Mekanik industri, 32% dan 68%. **30)**. Menganalisis dan menunjukkan pemeliharaan reaktif (reactive maintenance) pada mesin industri, 26% dan 64%. **31)**. Menerapkan dan mendemonstrasikan final cek komponen mekanik dan electrical pada mesin industri, 22% dan 76%. **32)**. Menerapkan dan mendemonstrasikan pengelolaan pekerjaan bengkel manufaktur, 20% dan 54%. **33)**. Menganalisis gangguan, kerusakan dan mendemonstrasikan perbaikan pada komponen pneumatic/hidrolik mesin industri, 26% dan 74%. **34)**. Memahami dan mendemonstrasikan macam-macam jenis dan konsep fluida pada sistem pneumatic/hidrolik untuk mekanik industri, 38% dan 54%, **35)**. Memahami konsep dan menunjukkan prinsip kerja simbol dan diagram listrik pada mesin produksi, 30% dan 66%. **36)**. Menganalisis dan mendemonstrasikan pekerjaan pemeliharaan/gangguan pada sistem rangkaian kelistrikan mesin perkakas/produksi, 32% dan 62%. **37)**. Menerapkan dan melakukan prinsip pemeliharaan rangkaian elektro pneumatik dan elektro hidrolik, 20% dan 76%. **38)**. Menerapkan dan mendemonstrasikan aturan gambar pada pekerjaan gambar konstruksi mesin, 44% dan 52%. **39)**. Menganalisis dan menunjukkan hasil analisis pada teknik gambar konstruksi mesin, 24% dan 70%. **40)**. Mengevaluasi dan mendesain gambar konstruksi mesin dengan berbagai jenis sambungan, 20% dan 70%. **41)**. Menganalisis dan menunjukkan aturan tanda pengerjaan dan harga kekasaran pada gambar detail komponen mesin, 18% dan 68%. **42)**. Menerapkan dan mengimplementasikan aturan toleransi pada

gambar komponen mesin, 32% dan 60%. **43)**. Mengevaluasi perubahan dan memodifikasi pada gambar komponen mesin dan produk rakitan, 30% dan 56%. **44)**. Memahami jenis jenis produksi dan menerapkan prosedur aliran proses dalam industri manufaktur, 28% dan 70%. **45).** Menerapkan dan melakukan pengukuran kinerja dari suatu sistem produksi pada industri manufaktur, 24% dan 70%. **46)**. Menganalisis dan melakukan perencanaan lokasi dan standar produksi dalam industri manufaktur, 26% dan 66%. **47)**. Menganalisis dan memperbaiki hasil produksi yang tidak efektif dan efisien (waste), 30% dan 64%. **48)**. Menerapkan dan melakukan perbaikan terus menerus (continous improvement) dalam pengelolaan produksi, 62% dan 34%. **49)**. Memahami dan menerapkan sistem produksi just in time dalam industri manufaktur, 32% dan 66%. **50).** Menyajikan dan Menganalisis rancangan pengendalian biaya produksi yang optimal, 22% dan 76%. **51)**. Menganalisis dan mengelola lingkungan kerja sesuai konsep perencanaan produksi, 14% dan 84%. **52)**. Menganalisis dan mengolah data peramalan jumlah permintaan produksi, 24% dan 66%. **53)**. Menerapkan dan mendemonstrasikan peta proses operasi untuk produksi manufaktur, 24% dan 70%. **54)**. Menerapkan dan melaksanakan prosedur proses produksi dari awal hingga akhir produski. (material, waktu, kapasitas), 32% dan 68%. **55)**. Melaksanakan dan Memahami konsep, prosedur dasar pengendalian gudang (in,out, mutu), 34% dan 64%. **56)**. Mengolah dan Menganalis keseimbangan persediaan barang, 30% dan 58%. **57).** Melaksanakan dan Menganalisis pembongkaran, pemindahan dan penataan barang yang efektif dan efisien, 32% dan 62%. **58)**. Memahami klasifikasi dan mendemonstrasikan penggunaan peralatan yang digunakan dalam gudang (peralatan utama, pendukung), 22% dan 74%. **59)**. Menerapkan dan melakukan proses perawatan dan pemeliharaan peralatan dan perlengkapan gudang, 38% dan 60%. **60)**. Memahami dan melaksanakan prosedur distribusi dan penataan dengan konsep memperpendek jarak/saluran distribusi barang dari produsen ke konsumen, 30% dan 64%. **61)**. Memahami dan melakukan azas penyaluran barang berdasarkan ketepatan jenis dan spesifikasi produk, ketepatan nilai produk, ketepatan jumlah produk, ketepatan waktu dan tempat penyampaian, 50% dan 48%. **62)**. Menerapkan pencatatan data keluar masuk barang beserta peralatan gudang yang digunakan dengan menggunakan sistem informasi pergudangan, 26% dan 72%. **63)**. Menerapkan dan mendemonstrasikan proses penanganan material dengan menggunakan sistem informasi pergudangan, 34% dan 64%. **64).** Memahami dan menerapkan dasar-dasar dan sistem keselamatan kerja, 62% dan 38%. **65)**. Memahami

dan melaksanakan prosedur Keselamatan Kerja dalam semua proses pekerjaan pemesinan dan proses kerja industri, 78% dan 22%. **66**). Menganalisis dan mengelola Sumber-Sumber Bahaya dan potensi bahaya yang ditimbulkan pada pekerjaan pemesinan manufaktur, 72% dan 28%. **67**). Menerapkan dan mendemonstrasikan alat-alat standar keselamatan kerja sesuai prosedur pada pekerjaan pemesinan manufaktur, 62% dan 38%.

B. Luaran yang di capai Penelitian

Berdasarkan indikator capaian penelitian gambar 3, yang telah ditetapkan sebelumnya, luaran penelitian yang telah ditargetkan dapat tercapai yaitu:

1. Publikasi internasional, melalui seminar internasional ICEST 2018 Conference Proceedings Empowering Educational Human resources for Global Competitiveness, 1st International Conference on Educational Science and Training 2018, Volume 2018. Universitas Bung Hatta Padang, pada tanggal 13-14 Agustus 2018, dengan judul *Work Skills Factor for Mechanical Engineering Students of Vocational High School*. DOI 10.18502/kss.v1i2.649.

2. Publikasi pada Pada jurnal Teknologi Malaysia. Indeks Scopus Q3.

3. Hak Cipta terdaftar untuk publikasi karya ilmiah, dengan nomor pencatatan 000107686 tanggal 8 Mei 2018.
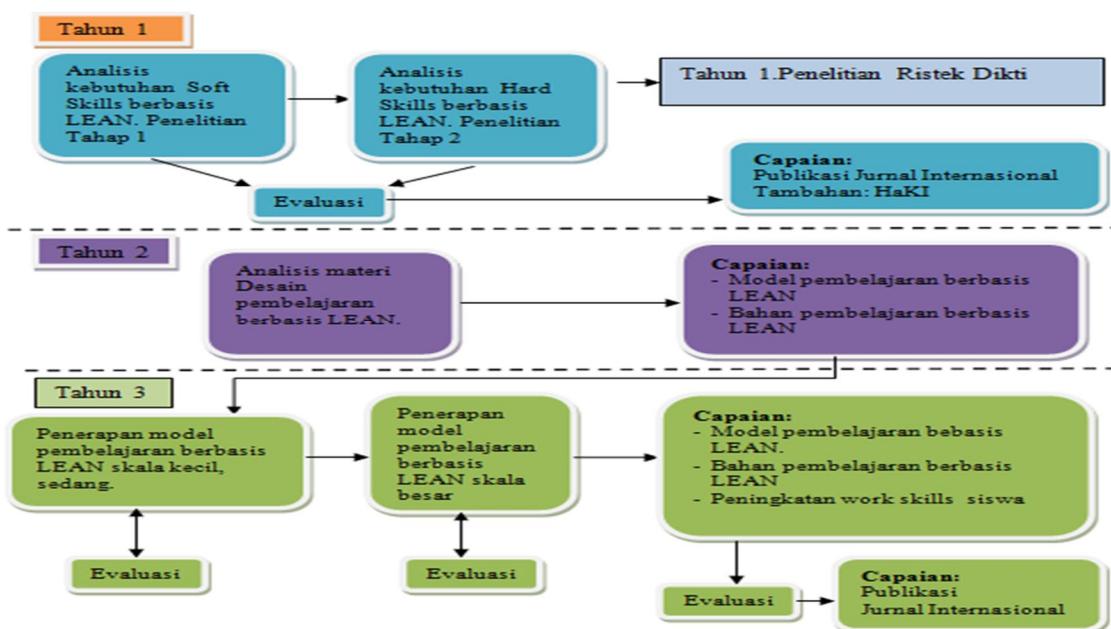
Gambar 3. Indikator Capaian Penelitian.

BAB 6. RENCANA TAHAPAN BERIKUTNYA

Merujuk pada Road Map Penelitian Pengembangan Model Pembelajaran Berbasis Lean, maka rencana penelitian adalah merujuk pada gambar 4, yaitu pelaksanaan penelitian tahap III di tahun kedua pengajuan ke Ristek Dikti tahun 2019-2020, yaitu dengan melaksanakan analisis desain pembelajaran berbasis lean dengan luaran penelitian dalam bentuk desain instruksional pembelajaran yang didukung dengan bahan ajar berbasis lean untuk siswa SMK jurusan Teknik Mesin. Berdasarkan tahap III untuk penelitian tahun ke 2, diharapkan memenuhi target capaian berupa Desain baru model pembelajaran berbasis Lean dan buku ajar ber ISBN.
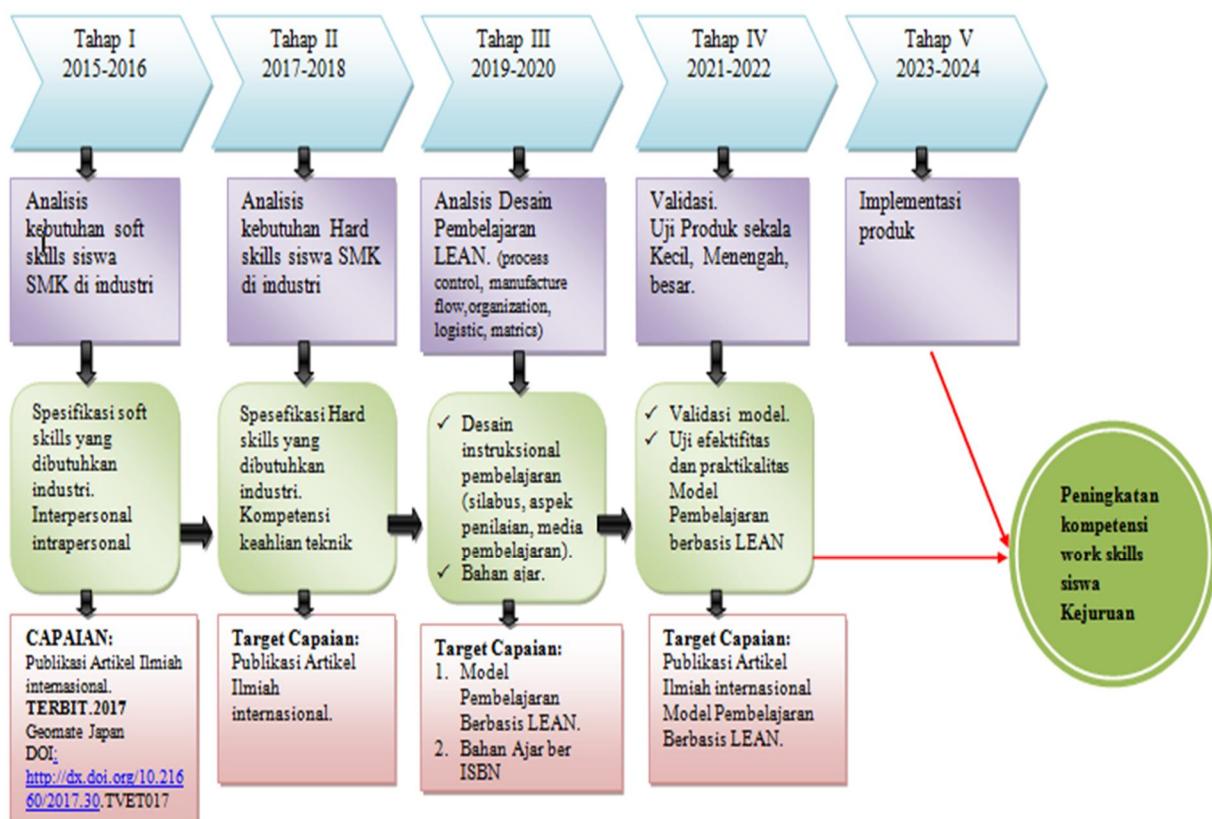
Gambar 4. Road map penelitian

Tahun II. Analisis Desain Pembelajaran Berbasis LEAN.
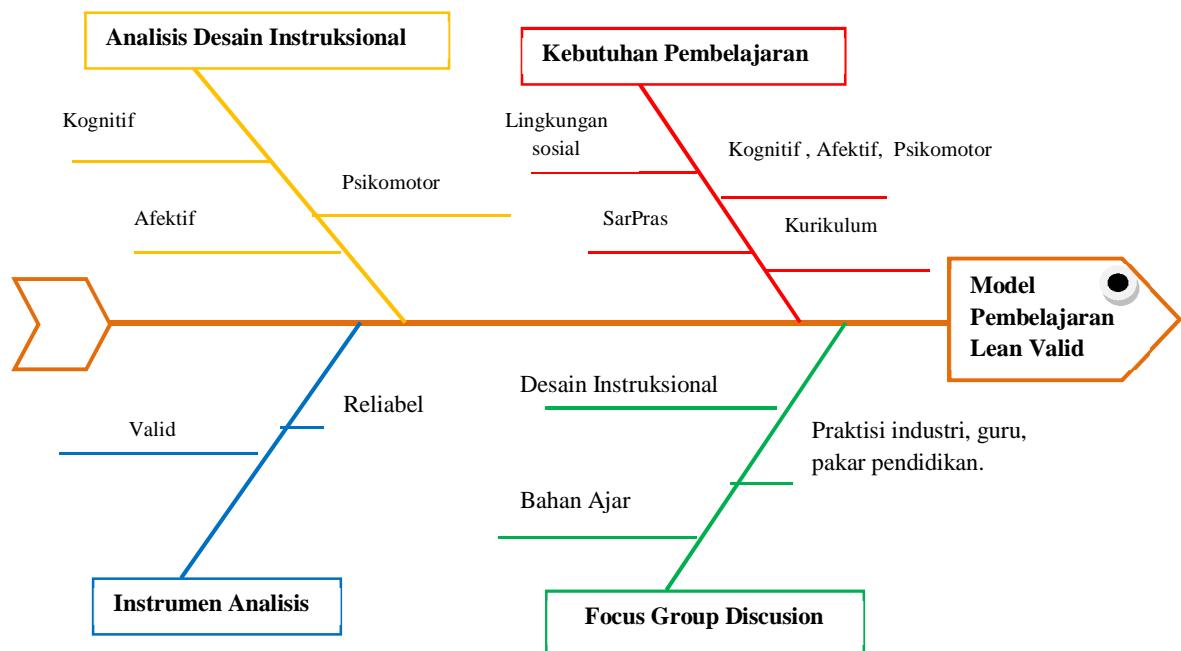
Gambar 5. Fish bone chart penelitian Tahun II

Tabel 1. tahapan penelitian selanjutnya untuk tahun ke-2

NO	Kegiatan	Tahun II											
		Bulan											
		1	2	3	4	5	6	7	8	9	10	11	12
1.	Menyusun proposal penelitian lanjutan	▓	▓	▓									
2.	Pengurusan surat ijin dan pengambilan data				▓								
3.	Pengumpulan data					▓	▓	▓					
4.	Pembuatan produk						▓	▓	▓				
5.	Validitas Instrumen									▓			

NO	Kegiatan	1	2	3	4	5	6	7	8	9	10	11	12
	dengan pakar									■			
6.	FGD Desain instruksional dan Buku ajar.										■		
7.	Pelaporan danSeminar presentasi											■	
8.	Perbaikan dan penggandaan											■	
9.	Pelaporan Bahan Ajar dan model pembelajaran Lean.												■

Tabel 2. tahapan penelitian selanjutnya untuk tahun ke-3

NO	Kegiatan	Tahun III											
		Bulan											
		1	2	3	4	5	6	7	8	9	10	11	12
1.	Menyusun proposal penelitian lanjutan	■	■										
2.	Pengurusan surat ijin dan pengambilan data			■									
3.	Uji coba dan penerapan produk, sekala kecil, sedang dan besar.				■	■	■	■	■				
4.	Revisi Produk Pembelajaran dan model									■	■		
5.	Penulisan laporan hasil penelitian											■	

6.	Seminar presentasi												▓	
7.	Perbaikan dan penggandaan												▓	
8.	Pelaporan dan publikasi jurnal internasional													▓

BAB 7. KESIMPULAN DAN SARAN

A. Kesimpulan

Berdasarkan hasil penelitian dengan analisis kebutuhan work skills faktor yang sudah dilakukan, terdapat 27 item *soft skills* yang dipilih oleh responden. Soft skills tersebut dibagi menjadi dua bagian yaitu 12 indikator untuk soft skills umum dan 15 indikator soft skills khusus. Untuk hard skills, terdapat 67 item indikator yang dibutuhkan untuk mendukung kompetensi kejuruan teknik mesin. Dengan demikian indikator soft skills dan hard skills telah terpilih sesuai dengan kebutuhan industri atau dunia kerja pada bidang teknik mesin menjadi komponen work skills kejuruan. Maka work skills tersebut harus dimiliki oleh siswa Jurusan Teknik Mesin SMK sebagai salah satu kompetensi yang diperlukan. Berdasarkan hasil analisis kebutuhan work skills maka dijadikan sumber rujukan untuk mengembangkan desain model pembelajaran berbasis lean. Model pembelajaran ini akan disusun secara sistematis sebagai upaya perbaikan proses pembelajaran untuk meningkatkan work skills siswa kejuruan jurusan teknik mesin Sekolah menengah kejuruan.

B. Saran

1. Kompetensi kejuruan sangat perlu merujuk pada perkembangan dunia kerja agar lulusan sekolah kejuruan mampu beradaptasi dan mengisi pasar kerja yang sesuai keahlian.

2. Rujukan kompetensi sesuai kebutuhan dunia kerja perlu disusun menjadi acuan pembelajaran di sekolah dengan berbagai metode, yang bertujuan mencapai kompetensi jurusan.

3. Industri seharusnya memberikan peran signifikan untuk pengembangan pendidikan terutama pendidikan kejuruan, dalam hal pertukaran informasi, pengetahuan teknologi agar pendidikan mampu menyesuaikan dengan kebutuhan dunia kerja.

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Work Skills Factor for Mechanical Engineering Students of Vocational High School

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Abstract

Vocational education graduates are indicated having the very low competence and cannot meet the expectations of the work requirement, it has an impact on lower absorption of employment for vocational education regionally and nationally. In order to meet the needs of the job competence, vocational students should have good work skills. The purpose of this study was to determine the need for skills of work consisting of soft skills and hard skills for vocational education students of mechanical engineering. This research was quantitative descriptive analysis conducted by using Dacum approach. The sample of the study consisted of 100 respondents, comprising industry practitioners, vocational education practitioners, and relevant expert of vocational education in engineering. Based on the analysis, there are 27 items of soft skills and 67 items of hard skills recommended for works for vocational students. Based on the analysis, the findings will be used as a reference for developing a lean-based learning model to improve the work skills of vocational students of mechanical engineering.

Keywords: Need and analysis, Work Skills, soft skills, hard skills

CERTIFICATE
OF APPRECIATION

This certificate is presented to

Suyo Hartanto

as a **Presenter**

International Conference on Educational Science and Training

August 14th, 2018 | Pangeran Beach Hotel, Padang Indonesia

with a paper entitled :

Work Skills Factor for Mechanical Engineering Students of Vocational High School

Rector of Bung Hatta University

Prof. Dr. Azwar Ananda, MA

Conference Chair

Dr. Hendra Hidayat, M.Pd

OUR REF: UTM.J.53.05.01/19.11/1JLD 1(5)

YOUR REF: 1 NOVEMBER 2018

SURYO HARTANTO
RIAU KEPULAUAN UNIVERSITY

Dear Sir/Madam,

CONFIRMATION AS PRESENTER FOR **TECHNICAL & VOCATIONAL EDUCATION AND TRAINING INTERNATIONAL CONFERENCE (TVETIC2018)**

Thank you for your kin interest in participating the **TECHNICAL & VOCATIONAL EDUCATION AND TRAINING INTERNATIONAL CONFERENCE (TVETIC2018)**, which will be held on **26 – 27th November 2018** at KSL Resort & Hotel, Johor Bahru.

2.   With reference to the above matter, we hereby confirm your accepted papers for parallel session during TVETIC 2018.

Paper Title: WORK SKILLS FACTOR FOR MECHANICAL ENGINEERING STUDENTS OF VOCATIONAL HIGH SCHOOL
Authors :   Suryo Hartanto, Sri Langgeng Ratnasari and Zaenal Arifin

3.   We would also like to inform that you may now proceed with your payment of TVETIC2018 as a presenter **before 15th November 2018**. The official payment receipt can be collected from the Registration Committee on the day of the conference.

Thank you for your kind cooperation and attention on the above matter. We look forward to see you at the conference.

"TVET Towards Industrial Revolution 4.0"

(DR NUR HUSNA ABD WAHID)
Conference Chair,
Technical & Vocational Education and Training International Conference (TVETIC2018)
School of Education
Faculty of Social Sciences and Humanities
(Formerly known as Faculty of Education)

Pada tanggal Sen, 15 Okt 2018 pukul 07.58 TVETIC2018 <tvetic2018@easychair.org> menulis:

TVETIC 2018 notification for paper 2

Dear Suryo Hartanto:

Thank you for your kind interest in participating TECHNICAL & VOCATIONAL EDUCATION AND TRAINING INTERNATIONAL CONFERENCE (TVETIC 2018).

2. With reference to the above matter, we would like to congratulate that your paper 2, WORK SKILLS FACTOR FOR MECHANICAL ENGINEERING STUDENTS OF VOCATIONAL HIGH SCHOOL has been accepted for ORAL PRESENTATION in the CONFERENCE which will be held on 26 - 27 November 2018, at KSL Resort & Hotel, Johor Bahru, Malaysia.

3. You can find the reviewers' comments below for your kind information. Please address these comments while preparing your final camera ready paper.

4. The accepted paper(s) will be published in the JOURNAL OF TECHNICAL EDUCATION AND TRAINING (SCOPUS), subjected to the PUBLISHER'S DECISION AFTER ANOTHER ROUND OF REVIEW BY THEIR EDITORIAL TEAM.

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We look forward to welcoming you to Johor Bahru, Malaysia in November 2018.

Regards
TVETIC2018 COMMITTEE

WORK SKILLS FACTOR FOR MECHANICAL ENGINEERING STUDENTS OF VOCATIONAL HIGH SCHOOL

ABSTRACT

Vocational education graduates are indicated having the very low competence and cannot meet the expectations of the work requirement, it has an impact on lower absorption of employment for vocational education regionally and nationally. In order to meet the needs of the job competence, vocational students should have good work skills. The purpose of this study was to determine the need for skills of work consisting of soft skills and hard skills for vocational education students of mechanical engineering. This research was quantitative descriptive analysis conducted by using Dacum approach. The sample of the study consisted of 100 respondents, comprising industry practitioners, vocational education practitioners, and relevant expert of vocational education in engineering. Based on the analysis, there are 27 items of soft skills and 67 items of hard skills recommended for works for vocational students. Based on the analysis, the findings will be used as a reference for developing a lean-based learning model to improve the work skills of vocational students of mechanical engineering.

Keywords: Need and analysis, Work Skills, soft skills, hard skills

1. INTRODUCTION

Vocational education is organized as an effort to prepare individuals in reaching expected competency skills, in order to sustain the life of the individual, the workplace, and develop a career in the future, (Calhoun And Finch 1982: 60; Law No.20.2003 article 15; Hartanto, at.al, 2017). Graduates of Vocational High School should be addressed as graduates who are ready to work, intelligent, have a competitive advantage, comparative and strong character as a working professional, so that the mastering of *hard skills and soft skills* must be covered very well to be excellent and better quality graduates in facing the world competition of work. Galuh (2013), hard skills must be balanced with soft skills, and *soft skills* have a tendency as a decisive factor in the recruitment process. With the vocational schools, employment could be provided with good; however, the level of employment absorption of graduates of Vocational High School is not balanced with the condition of *the hard skills and soft skills* possessed by employees graduated from Vocational High School. The absorption of employment nationally for Vocational Senior High Schools (SMK) are 10.87%, lower than high School graduates who are at 20.52%, for Junior high school is to 18.16% even for elementary school levels is far greater for 42.23%, which means there are a lot of unemployment and high employment absorption differences between graduates of the education levels. For example, one of the provinces in Indonesia, Riau Islands, has been carrying out development with a complete infrastructure in several areas: agriculture, marine and industrial. Indonesian Central Bureau of Statistics (2017), in accordance with the engine works, the number of workers absorbed in the field of industry of manufacturing and machining in Riau Islands was 41.20%. The majority of the industry is located in Batam, but the uptake of its workforce is still very low. An important issue must be resolved. It should be with great potential that can be used to resolve such issues, especially vocational schools in order to meet the needs of the industry, the world of work and increasing the number of employment absorption of the vocational education.

Learning at SMK has not approached aspects of *hard skills and soft skills* comprehensively and thoroughly so that graduates are not quite enough to have *hard skills and soft skills,* that industry needs. Developing *hard skills and soft skills* directly integrated with the work process form the experience *of hard skills and soft skills* in the learning process directly. (Palmer, 2007; Lubis 2010; Hartanto, 2017), SMK can improve the competency skills through appropriate learning strategies to fit the needs of work, improving knowledge, attitudes, skills, and values that are needed for the job. Students should be provided with the knowledge, skills, attitudes, and values necessary in a real working environment. (Prossers, 1949; Hartanto. 2017) integrated learning with the world of work, provide experience to students and build bridges between school education with the professional working world. Learning that is integrated with real working world provides a huge benefit in the acquisition of vocational competence. (Blum, 2007; Sousa, 2011) Integration with the world of work is a form of environmental role to change the competence of vocational students achieving sustainable development.

The learning system should be established in accordance with the needs of the community, this analysis is an important step to map the special needs of work skills in the mechanical

engineering department of SMK to be used as a reference in composing the learning. The aim of this research is to determine the extent of needs of soft skills and hard skills for SMK students as an effort to develop work competence skills of students majoring mechanical engineering.

2. LITERATURE REVIEW

The dynamic changes in the industry need to be observed so that learning process that is similar to the industry standard is necessary. Learning is a process toward change. Learning is the process of Obtaining mastery, knowledge, habits, which is Obtained from the process of learning, (Saiful Bahri Djamarah, 1996). The knowledge that is Obtained in the form of facts, concepts, procedures, and principles of students characteristic can do so by involving interaction with the external environment that can change someone's behavior, (Saiful Bahri Djamarah, 1996; Robert, 1992; Rukun, Huda, and Hartanto, 2015). Vocational education must have the principle of change in accordance with the needs of society and technology. Prosser's (1949:34)the second proposition, *"Effective Vocational training can only be given where the training jobs are carried on in the same way with the same operations, the same tools and the same machines as in the occupation itself*". Vocational education can produce competent workforce should meet these standards. Vocational education as one vehicle to prepare students for the world of work must be future-oriented. (Adrian, 2005,443), *socialize people into attitudes appropriate for the world of work*, *orientate people to understand the world of employment and to prepare for the choices and transition they will have to make on entering it*, *prepare them with specific skills and knowledge to apply in a direct way after entering employment.*

Appropriate learning is integrating it with the industry. The main principle in the industry is to achieve efficiency and high productivity. It was implemented by way of applying *Lean Manufacturing*. Lean is a production system that claims to create learning organizations through continuous improvements (Liker and Meier, 2006, Anna, at.al, 2015).William (2001). *The Five Primary Elements for lean manufacturing are (1) Manufacturing Flow, (2) Organization, (3) Process Control, (4) Metrics, and (5) Logistics. Lean manufacturing* is a concept and principles used in the company and the production process to maximize the work to achieve the maximum benefit by applying the five principles with no separation. William (2001, 21) *"Lean manufacturing, is primarily focused on designing a robust production operation that is responsive, flexible, predictable, and consistent.* Lonnie (2010) states that *it is called Lean because, in the end, the process, it can run: Using less material, requiring less investment, Using less inventory, Consuming less space and, using fewer people.* Achieving high efficiency and productivity at work, vocational school graduates must have the skills of work in accordance with the needs of the workforce. *Work Skills,* a skill that needs to be owned by individuals in the process of work, consists of hard skills and soft skills. *Hard skills* in vocational education are one among the *skills* that must be possessed by vocational students to achieve competence. Hartanto (2017:157), *"There are some skills that are specific to needs in industry and manufacturing, the skills need will be very important as a defense to face of the information development and the environment rapidly".* *Hard skills* are abilities related to something that can be learned in education aimed at improving intellectual ability. Coates (2006,1) argues that *hard skills are*

technical or administrative procedures related to an organization's core of the business. Mazoota (2015,1) states that *"Hard skills are skills where the rules stay the same regardless of which company, circumstance or people you work with."*, While *Soft skills* are the abilities of each individual, cannot be seen, but the *soft skills* are the ability to which play a huge role in one's life, which strongly support someone's ability, career and job (Hartanto.2017; Robles. 2012). *Appropriate soft skills play an important role in a successful career as well as during social interactions in the society. In addition, Reviews on these skills are highly sought after by employers recruiting fresh graduates,*(Majid and Liming, 2012;1036; Hartanto, 2017;156).

Soft Skills *are character traits, attitudes, and behaviors-rather than knowledge or technical aptitude. Soft skills are the intangible, nontechnical, personality-specific skills that determine one's strengths as a leader, facilitator, mediator, and negotiator,* (Hartanto.2017;157,Robles;457). Coatest (2006;1) says that *"They have to do with how people relate to each other: communicating, listening, engaging in dialogue, giving feedback, cooperating as a team member, solving problems, contributing in conducted some first-rate training and was well meetings and resolving conflict"*. Chaturvedi (2011:,5), in line state, that *"the impact which the soft skills training could give in enhancing the output of hard skills"*. *"Soft skills play a crucial role in making students employable as it enables them to be flexible, positive to change, handle ever-increasing expectations of employers and to stay globally competitive"*. (Rani-, 2010:,4) proposes the structure of the future work in the industrial world will eliminate more jobs of *non-skills,* which will be replaced with jobs that require skills, a high expertise in the areas of reading, computation, communication, and problem-solving or reasoning skills.

Work Skills needed by industry is done by using Dacum needs analysis approach. This approach is used in a variety of methods to determine the accuracy of the use of learning and competency mapping by practitioners or specialists who have done the work and activities in accordance with the areas of expertise (Hartanto, 2017; Norton.2004). The results of the analysis will show the gap between teachings and learn in a vocational school with work processes and activities in the industry. The gap found will be a basis for the development to improve the learning process through Lean-based learning model.

3. RESEARCH METHOD

Type of this research was descriptive quantitative, through DACUM (Developing a Curriculum) approach. a method analysis technique job/occupational that recognized by industry practitioners, educators, and consultants to effectively identify the duties, tasks, and related information required for a job/occupation. It also provides an excellent source of data for management decision-making, developing a training program, human resource development, career planning, needs assessment, test development, job redesign, performance evaluations, and quality control Planning. (Norton, 2004:3, Hartanto, 2017:157). The sample of this study was 100 respondents by using random sampling. It consisted of teachers of Mechanical Engineering Department, Practitioner of Machining Industry, and Expert/Lecturer of mechanical for the vocational high

school of Mechanical Engineering. The research instrument used was a questionnaire that is based on the prepared blueprint in accordance with the needs of work skills of the vocational high school of Mechanical Engineering. The questionnaire used a Likert scale (Hartanto; 2018;2). Validity and reliability of research instrument used expert judgment that consisted of seven experts

4. RESULTS AND DISCUSSION

The results of needs analysis of work skills are categorized into two parts: *soft skills* and *hard skills* for SMK students who are majoring mechanical engineering. For engineering needs of *work skills* in Mechanical Engineering of Vocational High school, it was used questionnaires which were filled out by respondents by using four categories of the scale options of Likert; very Important, Important, Less Important and Not Urgent. Response to work skills needed by using the questionnaire was determined through respondents' level of achievement. Decision criteria of the level of achievement of response were assigning a minimum of 50% of the total number of respondents' preferences through a questionnaire to the category selection agree and strongly agree. Based on the level of achievement of the indicator, there was elected as new recommendations for the establishment of indicators on soft skills and hard skills of students of vocational education in mechanical engineering. The results of the analysis are used in an attempt to build a new learning model of Lean-based learning model design for vocational high school students in an effort to improve work skills and competencies. New learning model will build by using research and development methode, in next step. The following is described further about respondents' level of achievement indicators and tables on recommended soft skills and hard skills.

4.1 Soft Skills

Needs analysis of soft skills was categorized into two parts, namely general soft skills and specific soft skills in the field of machining jobs (Hartanto, at.al. 2017).

Table 1: Responden respons general soft skills category

No	General Soft skills category of machining jobs	Questionnaire category	
		Strongly agree.	agree
1	Demonstrating a willingness to develop a career	68	32
2	Showing ethics of communication	80	20
3	Showing the relationship among individuals	76	24
4	Showing good cooperation	92	8
5	Showing a high work ethic	78	20
6	Showing the action to solve the problem	56	42
7	Maintaining a presence on time	70	30
8	Indicating high initiative	56	42
9	Demonstrating honesty	82	18
10	Obeying all the rules work	64	34
11	Showing a responsible attitude	84	16
12	Showing a good adaptation in working,	50	46

Table 2; Responden Respons special soft skills

No	Special Soft skills in machining jobs	Questionnaire category	
		Strongly agree.	agree.
1	Complying with the work process in accordance with the plans and design drawings	68	26
2	Adhering to the quotas for production	56	38
3	Showing the attitude of loyalty to the company	66	30
4	Motivated for training and teaching work processes	58	42
5	Showing the planning and operations according to the specifications of products.	46	50
6	Demonstrating Warming up the engine	44	52
7	Showing the readiness of operational equipment.	62	36
8	Showing the check engine units	64	36
9	Setting the machine according to product specifications.	74	26
10	Demonstrating material handling right.	52	44
11	Demonstrating health and safety at work.	80	18
12	Suggesting caution in operating the machinery.	74	26
13	Indicating maintenance and engine maintenance.	66	34
14	Demonstrating checking the work according to standards of quality	62	34
15	Demonstrating off the machine according to the procedure.	78	20

4.2 Hard Skills.
Table 3: Responden Respons Hard skils. Manufactur drawing

No	Hard Skills in machining jobs. Manufactur drawing	Questionnaire category	
		strongly agree.	agree
1	Understanding and applying the rules engine drawing techniques and workmanship mark.	54	46
2	Understanding and demonstrating basic concepts, the command functions of Computer Aided Design (CAD).	46	54
3	Understanding and presenting a detailed picture making, etiquette of machine components with CAD drawings in accordance with ISO.	42	56
4	Analyzing and demonstrating the manufacture of engine components detailed images (projected images, image pieces and giving the size, tolerance, adjusting, a sign of craftsmanship and surface roughness value) with 2D/3D CAD.	48	50

Table 4: Responden Respons hard skills Lathe Machining

No	Hard Skills in machining jobs. Lathe Machining	Questionnaire category	
		strongly agree.	agree
5	Understanding and identifying the parts lathe by its type and function.	48	46
6	Understanding, analyzing and identifying the suitability of the cutting tool lathe machines.	24	70
7	Implementing and presenting procedures of eccentric turning technique.	22	78
8	Evaluating and determining the procedure for turning technique	34	60

No		strongly agree	agree
	eccentric.		
9	Analyzing and determining the making workpiece by using a faceplate.	20	74
10	Implementing and making the technical procedure of making the workpiece assemblies, using various ways.	30	52

Table 5: Responden Respons hard skills machining.Milling Machine

No	Hard Skills in machining jobs. Milling Machine	Questionnaire category	
		strongly agree.	agree
11	Understanding and identifying parts of the milling machine based on the type and function.	36	56
12	Analyzing and identifying the use of cutting tools on milling machines.	28	64
13	Evaluating and using a milling machine cutting parameters for different types of work.	22	62
14	Implementing and using the standard operating procedure of fraising technique in all forms of the workpiece.	38	58

Table 6: Responden respons hard skills machining. Grinding Machine

No	Hard Skills in machining jobs. Grinding Machine	Questionnaire category	
		strongly agree.	agree
15	Understanding and identifying the grinding machines for various kinds of work.	34	56
16	Implementing and operating engineering machining surface grinders for various types of work.	14	68
17	Choose and use cutting parameters grinding machines for various kinds of work.	14	58
18	Evaluating and using grinding machining techniques on various types of work.	10	78

Table 7: Responden respons of hard skills machining. NC / CNC and CAM Machining

No	Hard Skills in machining jobs, NC / CNC and CAM Machining	Questionnaire category	
		strongly agree.	agree
19	Understand and identify the parameters and parts on a lathe and CNC milling	28	68
20	Implementing and operating all the procedures at each work machining lathe and milling CNC.	24	72
21	evaluating and repairing the failure of the work of a lathe and milling CNC.	32	62
22	Analyzing and demonstrating Computer Aided Manufacturing (CAM) 2D and 3D for the process milling, lathe facing and drilling.	30	58
23	Evaluating the use of CAM program through the simulation process on all machining jobs.	28	58

Table 8: Responden respons hard skills machining. Industrial Mechanical Engineering

No	Hard Skills in machining jobs. Industrial Mechanical Engineering	Questionnaire category	
		strongly agree.	agree
24	Understanding the concept and adhere to the appropriate maintenance manual/surgery.	48	46
25	Understanding the types, functions and demonstrating major	30	68

No		strongly agree.	agree
	maintenance tools mechanical and electrical.		
26	Understanding and classifying the types of disorders of the mechanical components of industrial machinery.	42	52
27	Analyzing the damage and performing minor repairs industrial machinery mechanical components.	30	64
28	Implementing and performing maintenance procedures / mechanical repair industry engine (compressor, pump, and motor gasoline).	46	46
29	Analyzing and demonstrating preventive maintenance in the mechanical industry.	32	68
30	Analyzing and showing the reactive maintenance (reactive maintenance) in industrial machinery.	26	64
31	Implementing and demonstrating a final check of mechanical and electrical components in industrial machinery.	22	76
32	Implementing and demonstrating management workshop manufacturing jobs.	20	54

Table 9: Responden respons hard skills machining. Pneumatic and Hydraulic Systems

No	Hard Skills in machining jobs Pneumatic and Hydraulic Systems	Questionnaire category	
		strongly agree.	agree
33	Analyzing disruption, damage and demonstrated improvements to components of pneumatic / hydraulic machinery industry.	26	74
34	Understanding and demonstrating various types and concepts of fluid in the system of pneumatic / hydraulic to mechanical industry.	38	54

Table 10: Responden respons hard skills machining. Industrial Machinery Electrical System

No	Hard Skills in machining jobs Industrial Machinery Electrical System	Questionnaire category	
		strongly agree.	agree
35	Understanding the concept and demonstrating the working principles of electrical symbols and diagrams on a production machine.	30	66
36	Analyzing and demonstrating the maintenance work/disruption in the electrical circuit system of machine tools/production.	32	62
37	Implementing and practicing the principles of electro-pneumatic circuit maintenance and electro-hydraulic.	20	76

Table 11: Responden respons hard skills machining. design and drawing machine

No	Hard Skills in machining jobs Design and Drawing Machine	Questionnaire category	
		strongly agree.	agree
38	Implementing and demonstrating the rules of drawing on machine construction drawing work.	44	52
39	Analyzing and showing the results of analysis on engineering construction drawing machines.	24	70
40	Evaluating and designing construction drawing machines with various types of connections.	20	70
41	Analyzing and demonstrating the rules sign workmanship and price roughness on the picture detail of engine components.	18	68
42	Applying and implementing rules engine component tolerances in the figure.	32	60

| 43 | Evaluating the changes and modify the image of engine components and product assemblies. | 30 | 56 |

Table 12. Responden respons hard skills machining. production control

No	Hard Skills in machining jobs. Production Control	Questionnaire category	
		strongly agree.	agree
44	Understanding the types of types of production and implementing procedures in the process flow of the manufacturing industry.	28	70
45	Implementing and measuring the performance of a production system in the manufacturing industry.	24	70
46	Analyzing and planning the location and the standard of production in the manufacturing industry.	26	66
47	Analyzing and improve production results which were not effective and efficient (waste).	30	64
48	Implementing and continuing improvement (continuous improvement) in the management of production.	62	34
49	Understanding and applying in time production system in the manufacturing industry.	32	66
50	Presenting and analyzing the design of an optimal control of production costs.	22	76
51	Analyzing and managing the work environment according to the concept of production planning.	14	84
52	Analyzing and processing data production forecasting total demand.	24	66
53	Implementing and demonstrating the operation process map for manufacturing production.	24	70
54	Applying and implementing procedures production process from beginning to end of production. (Materials, time, capacity).	32	68

Table 13: Responden respons hard skills machining logistics management

No	Hard Skills in machining jobs. Logistics Management	Questionnaire category	
		strongly agree.	agree
55	Implementing and understanding the concept, the basic procedure for warehouse control (in, out, quality).	34	64
56	Processing and analyzing inventory balance.	30	58
57	Implementing and analyzing the dismantling, removal and structuring effective and efficient goods.	32	62

Table 14. Responden respons hard skills machining. warehouse governance

No	Hard Skills in machining jobs. Warehouse governance	Questionnaire category	
		strongly agree.	agree
58	Understanding the classification and demonstrating the use of the equipment used in the warehouse (the main equipment, support).	22	74
59	Implementing and carrying out the process of care and maintenance equipment and supplies warehouse.	38	60
60	Understanding and implementing procedures for distributing and structuring the concept of shortening the distance/channel of	30	64

No		strongly agree	agree
	distribution of goods from producers to consumers.		
61	Understanding and carrying out the principle of distribution of goods based on the accuracy of the type and specifications of the products, the accuracy of the value of the product, the accuracy of the number of products, on time and delivery place.	50	48
62	Applying the data recording of goods in warehouse equipment used along with the use of the information system of warehousing.	26	72
63	Implementing and demonstrating the process of using the material handling warehousing information systems.	34	64

Table 14: Responden Respons hard skills machining. Safety at work

No	Hard Skills in machining jobs. Safety at work	Questionnaire category	
		strongly agree.	agree
64	Understanding and applying the basics and work safety system.	62	38
65	Understanding and implementing Safety procedures in all processes of machining work and industrial work processes.	78	22
66	Analyzing and managing Resources hazards and potential hazards posed to the manufacturing of machining jobs.	72	28
67	Applying and demonstrating tools safety standards according to the procedure in the manufacturing of machining jobs.	62	38

5. CONCLUSION

Based on the research with needs analysis needs of work skills that have been done, there are 27 items of *soft skills* chosen by the respondent. Soft skills are divided into 2 parts; they are 12 indicators for general soft skills and 15 for special soft skills indicator. For hard skills, there are 67 items of indicators needed to support vocational competence in mechanical engineering. Thus, indicators of soft skills and hard skills have been chosen according to the needs of the industry or the world of work in the field of mechanical engineering, which will be components of vocational work skills. Then the work skills must be possessed and mastered by students majoring in Mechanical Engineering of SMK as one of the necessary competence. Based on the needs analysis of work skills, then it will be set as a resource to develop Lean-based learning model. This learning model will be developed systematically as learning process improvement efforts to improve the work skills of vocational students majoring in mechanical engineering of SMK.

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REPUBLIK INDONESIA
KEMENTERIAN HUKUM DAN HAK ASASI MANUSIA

SURAT PENCATATAN
CIPTAAN

Dalam rangka pelindungan ciptaan di bidang ilmu pengetahuan, seni dan sastra berdasarkan Undang-Undang Nomor 28 Tahun 2014 tentang Hak Cipta, dengan ini menerangkan:

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Pencipta		
Nama	:	**Suryo Hartanto**
Alamat	:	Taman Lestari Blok D17 No. 16 RT.02/ RW.13. Kel Kibing, Kec. Batu Aji, Batam, Kepulauan Riau, 29433
Kewarganegaraan	:	Indonesia
Pemegang Hak Cipta		
Nama	:	**Suryo Hartanto, Suryo Hartanto,**
Alamat	:	Taman Lestari Blok D17 No.16 RT.02/ RW.13, Kel. Kibing, Kec. Batu Aji. , Batam, Kepulauan Riau, 29433
Kewarganegaraan	:	Indonesia
Jenis Ciptaan	:	**Karya Ilmiah**
Judul Ciptaan	:	**WORK SKILLS FACTOR FOR MECHANICAL ENGINEERING STUDENTS OF VOCATIONAL HIGH SCHOOL**
Tanggal dan tempat diumumkan untuk pertama kali di wilayah Indonesia atau di luar wilayah Indonesia	:	8 Mei 2018, di Batam
Jangka waktu pelindungan	:	Berlaku selama hidup Pencipta dan terus berlangsung selama 70 (tujuh puluh) tahun setelah Pencipta meninggal dunia, terhitung mulai tanggal 1 Januari tahun berikutnya.
Nomor pencatatan	:	000107686

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Surat Pencatatan Hak Cipta atau produk Hak terkait ini sesuai dengan Pasal 72 Undang-Undang Nomor 28 Tahun 2014 tentang Hak Cipta.

a.n. MENTERI HUKUM DAN HAK ASASI MANUSIA
DIREKTUR JENDERAL KEKAYAAN INTELEKTUAL

Dr. Freddy Harris, S.H., LL.M., ACCS.
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4th ASIA International Conference 2018 (AIC2018)

Acceptance of Abstract

Ref:AIC-2018-GDHEC-903

Dear SURYO HARTANTO SURYO HARTANTO,

I am pleased to inform you that your abstract entitled **Learning Material Analysis of Motorcycle Engine Tune-Up Practice Competency of Vocational High School Students** has been accepted for oral presentation in **4th ASIA International Conference 2018 (AIC2018)** after peer review by the editorial board (AIC2018). Please note that the conference will be held on 8-9 December 2018 at Langkawi International Convention Centre (LICC), Langkawi, Malaysia. You are hereby requested to upload full paper along with payment proof at http://portal.connectingasia.org/ within 14 days. Participants who can't ensure their presences at conference venue are allowed to present virtually through **video conferencing using Skype**. This paper will be published in an SCOPUS / ISI Indexed journal as mentioned in the conference website (see link for detail).

For future correspondence, use this **AIC-2018-GDHEC-903** as reference. If you have any queries, feel free to contact any of the undersigned accordingly.

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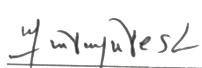
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Learning Material Analysis of Motorcycle Engine Tune-Up Practice Competency of Vocational High School Students

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Abstract

The gap appears between the demands of industrial work skills and the school circumstances in terms of student learning materials in the vocational high school of motorcycles engineering department. This study at revealing the learning materials scope of a 4-stroke engine tune-up among the students of motorcycle engineering department in the vocational high school. This study can be categorized as descriptive quantitative. The research respondents consisted of 30 people, they were mechanic, head of the mechanic, and Service Advisor (SA) from an authorized workshop of Honda or AHASS and the vocational high school teachers of motorcycles engineering. The research instruments used the questionnaires that had been examined for its validity and reliability. Based on the research result, industry party needs the learning material of 4-stroke motorcycle tune-up. It requires 100 topics/ subtopics of materials but there are only 35 topics/ subtopics covered in SMK syllabus. It means 65 topics/ subtopic as the gap. Moreover, the subject of 4-stroke motorcycle tune-up in motorcycle engineering department of vocational high school need to be adjusted to meet the standard requirements of the world of work for motorcycle engineering field as much as 65 topics/ subtopics

Keywords: Learning materials; engine tune- up; Vocational education

1   Introduction

The automotive world has developed rapidly in recent years and it requires creativity and innovation to seize the competition. Every year motorcycle manufacturers launch their new products by adopting the current sophisticated technology in order to compete and to dominate the market. For example, Honda as one of the biggest automotive manufacturer has several patented technology, such as Programed Fuel Injection (PGM-FI), Enhanced Smart Power (ESP) technology, swit stand, combi break system, Idling Stop System (ISS), Alternating Current Generator (ACG) starter.[3]

To respond the challenges of this technological advancement, vocational high school (Sekolah Menengah Kejuruan or SMK) plays an important role. Since SMK as a work oriented education program with one of its missions is to improve the quality of graduates in accordance with National Competency Standards.[7]. Vocational education is trying to prepare competent individuals to be able to develop careers in the future. However, it has not been completely achieved. The Central Bureau of Statistics in 2015 noted that the number of unemployment in Indonesia in August 2015 has increased into 110 thousand people becoming 7.56 million people from 7.45 million people in February 2015. Surprisingly, it is dominated by SMK graduates and the unemployment rate for vocational education occupies the highest position with 12.6%.

This condition is triggered by the lack of student competence in the working process, which is known during their internship or industrial work practices. Most of motorcycle companies that receive and train apprentices find that many students are inadequate to master knowledge and skills, especially in tune-up, electricity, and devices measurement. The students also often make mistakes in performing their work, such as periodic maintenance procedures of tune-up (checking and repairing), analyzing the problems on engine malfunction, determining the usage duration and the wear parts that must be replaced. The lack of competence has an impact with the indication of the increase in unemployment rate from SMK graduates. The problems mentioned above become one of the important signal for immediate improvement and change.

Education is a manifestation of dynamic human art and culture as well as the development requirement, therefore the change or the development of education should be followed and influenced by changes in all aspects of society (economy, science and technology, socio-cultural),[9]. the knowledge that is obtained in the form of facts, concepts, procedures and principles of the students can be so by involving interaction with external environment that can change someone's behavior.[12]. Changes, in the meaning of improving the educational process at all levels, need to be continuously done to anticipate of future interests.

To reduce the gap between the demands of industry-defined capability and the material learned in SMK, it requires the relevance from both parties to bridge the difference. An effort that can be made, such as by having industry assessment on the material that need to be given to vocational students as prospective workers. In addition, it is necessary to evaluate the material on SMK curriculum to answer the needs of the world of work. This relevance and the evaluation process can assist SMK in preparing ready-to-use graduates. The materials should be tailored to the community needs, the workplace needs, as well as it should be fun and interactive to build student skill competencies effectively. The learning materials in SMK presented in various competencies are important for the students' future. Those competencies are required to become intelligent Indonesian and competent workers based on the competency standards established by industry, business world

and professional associations. To achieve the standard of competence, the material content should be packed in groups of subjects and organized into normative, adaptive and productive program.

Motorcycle engineering department in SMK is designed to teach and to improve the competence of motorcycle engineering expertise. The Law of National Education System Article 3 and 15 states that vocational education is a secondary education that prepares students to work in a particular field. Specifically, the competence objective of motorcycle engineering expertise is to equip students with the skills, knowledge and attitude to be competent in the areas of maintenance and repair of motorcycle on a) engine, b) power transfer system, c) chassis and suspension, d) electrical systems.

The competence of motorcycle engineering in this research is related to competence for 4-stroke engine motorcycle. It includes in the category of motor fuel. The combustion engine is a kind of heat engine that converts the chemical from fuel into mechanical power and the conversion is carried out in the machine inside.[4]. In general, combustion engines in the ICE (Internal Combustion Engine) consists of two types of motor 4 and 2-stroke engine, each type has its own advantages and disadvantages. 4-stroke engine performs four steps process of suction, compression, power, and exhaust, twice crankshaft, one-time camshaft rotation and one burning or power.

The machine in motorcycle needs to be taken care to keep the engine in top performance. Tune-ups and schedules service that marginal and out-of-tolerance adjustments are routinely corrected.[1] Tune-up is part of regular maintenance activities on motorcycles, which include: a) examining the parts of the motorcycle to make sure it functions properly, b) cleaning the dirty parts to prevent the system damage c) setting the changed parts to match the specifications. d). repairing or replacing the wear parts. Tune-up consists of inspecting, testing, and adjusting the motorcycle. [1]. The part that get tune-up cover 1) fuel channel, 2) fuel filter, 3) hand gas system, 4. carburetor, 5) air filter, 6) spark plug, 7) swing valve, 8) engine oil, 9) oil filter, 10) stationary machine rotation, 11) chain wheel, 12) battery liquid (battery water), 13) oil brake discs, 14). wear of brake shoe, 15) brake system, 16) rear brake light switch, 17) headlights direction, 18). coupling System, 19) side-stand, 20) front & rear suspension, 21) bolt & fastener, 22) wheels or tires, 23) steering wheel head. [3].

2   Literature Review

Table 1. The Parts Of Motorcycle Tune-Up

Maintenance	Odometer Reading (Km)				
	500	2000	4000	8000	12000
fuel channel			P	P	P
fuel filter	B	B	B	B	B
hand gas system	P	P	P	P	P
Carburetor	P	P	P	P	P
air filter			B	B	B
spark plug	P	P	P	G	P
swing valve	P	P	P	P	P
engine oil	G	G	Every 2000km = G		
oil filter	B	B	B	B	B
stationary machine rotation	S	S	S	S	S
chain wheel	P&S	Every 500km = P& S			
battery liquid (battery water)	Every 500km = P				
oil brake discs	P	P	P	P	P
wear of brake shoe			P	P	P
brake system	P	P	P	P	P
rear brake light switch			P	P	P
headlights direction			P	P	P
coupling System	S	S	S	S	S
side-stand			P	P	P
front & rear suspension	P	P	P	P	P
bolt & fastener	P	P	P	P	P
wheels or tires	P	P	P	P	P
steering wheel head	P	P	P		P

Source: AHM. 2016
Explanation:
P: Periksa (check)
B: Bersihkan (Clean)
G: Ganti (Replace)
S: Setel (Setting)

The urgency of competent labor of motorcycle engineering expertise from vocational high school is affected by the advancement of technological transformation. It makes the learning materials analysis should be done to support the knowledge and ability of vocational high school students in order to compete future work world. This analysis is also

expected to be a reference for teachers and relevant to improve the competence of vocational high school students, especially for the motorcycle engineering field. The purpose of this study is to explain the scope of the practice material of 4-stroke engine motorcycle tune-up for motorcycle engineering department of SMK in order to fulfil the needs of the industry and the world of work.

3   Methodology/Materials

This research can be categorized as descriptive quantitative which is explorative without hypothesis. The research analysis used DACUM approach where Developing Curriculum is the most effective analytical technique. It is usually used by industry practitioners, educators and consultants to identify tasks, jobs and information related to jobs and jobs.[10], [7]. The research sample consisted of mechanic, head of workshop, service advisor at authorized Honda workshop (AHASS) amounted to 24 respondents from 6 workshops, 6 vocational teachers of motorcycle engineering from 2 vocational high school, so that the total sample was 30 respondents. The questionnaires was to measure the strength and weakness of the material scope of 4-stroke engine motorcycle tune-up using the respondents' opinion about the importance of material presented in the questionnaire.

 The content validity test was performed by 5 experts. The points that must be considered by the expert in reviewing the contents of the instrument including 1) the instrument should be based on the indicator, 2) the item is written short and clear, 3) the choice is in the form of good order numbers, 4) the similar component of each item is given the same score (the same score does not mean the answer option is similar), and 5) the item is written with the standard language.[8]. After having the expert validation analysis, this descriptive instrument met a very good criterion and can be used without revision meanwhile, for its reliability, the score was 0.679 with significance at 0.019, It mean then the overall instrument was declared valid and reliable

The analysis of learning material requirement of 4-stroke engine motorcycle tune-up was not expressed in terms of respondent's level of achievement of the percentage. The decision criterion were using the selected learning materials of 4-stroke engine motorcycle tune-up practice and it had the respondent's level of achievement which was more than 50% from the category of "very important" and "important",[7]. The results of the respondents' level of achievement was, then, compared with the current motorcycle learning materials in the vocational high school. The research decision making was the learning material found in the requirements analysis with the percentage of more than 50%, and, as the research finding, it can be used as reference for the curriculum structure changes or the additional material on motorcycle engineering for tune-up practice.

4   Results and Findings

The needs analysis is done to get a real picture on the job field of the expected competence in accordance with the employment needs,[7]. There are some skills that are demanded in the industry and manufacturing, the skills need will be very important as the defense of the information development and the environment rapidly. It shows that the specificity is very crucial in the industry or working world and it should be used by education institutions to be able to adapt to the current technology and today's people needs.

The respondents' responses on the learning materials for the 4-stroke motorcycles tune up categorized as "very important", "important", "less important", and "unimportant" to each item of the material. Furthermore, their 'answers were divided into "very important" and "important" category with "less important" and "unimportant" categories. It was to separate the learning materials considered important by the respondents which should be learned by the vocational students and the unnecessary one. The data showed that "important and "very important" category reached above 50% and 100 subjects/ sub topic material fell into the category of "very important" and "important". This category of "very important" and "important" then compared with the materials of 4-stroke motorcycles tune up in the current SMK curriculum. The recommended learning materials had not been listed in the SMK curriculum and those were considered very important to be taught to the vocational high school students of motorcycle engineering program.

Based on the comparison data on the material coverage, it was found that some material did not include yet in the syllabus of 4-stroke motorcycle tune-up subjects of vocational high school. The recent syllabus only covered 35 topics/ sub topics of material while, based on the research result, it should be 100 topics/ sub topics. It means the recommended material that should be added as much as 65 topics/ sub topic. Below are the topics/ sub topics based on the research findings.

4.1   35 The Topics/ Sub Topics of Tune-Up Materials Based on The Syllabus

1. Motorcycle fuel system: 1) knowing the components and the functions of the fuel system, 2) understanding and knowing the components and functions of the carburetor. 3) understanding and knowing the components of the fuel injection system, 4) Diagnostic error on the fuel system, 2. Repairing the engine and its components: 5) Understanding the engine maintenance, 3. Execute cylinder head overhaul and cylinder block: 6) disassembling the cylinder head components and the cylinder block. 7) measuring the cylinder head and the cylinder block based on the manufacturer's specifications, 4. Conducting periodic maintenance on the lubrication system: 8) understanding the function and the operation of the lubrication component. 9) diagnosis the lubricant system malfunction, 5. Conducting the cooling system treatment: 10). Diagnostic error on the cooling system, 6. Repairing the clutch unit on operating system components (manual & automatic): 11) identifying the clutch and the components operation system. 12) diagnostic error on the coupling system and its components operating system, 7. Conducting manual transmission repair: 13) identifying the components of manual transmission. 14) diagnostic error on the manual transmission system, 8. Conducting automatic transmission repair: 15) identifying the automatic transmission components. 16). Diagnostic error on automatic transmission systems. 17) Fixing the error one automatic transmission system, 9. Gear mechanism: 18) understanding the gear function and the operation system

19) identifying gear mechanism components. 20). Diagnosis the damage on gear mechanism, 10. Conducting repair of mechanical starter system: 21) understanding the function and the operation of mechanical starter, 22) mechanical starter repair, 11. Repairing the suspension system / Shock absorbers: 23) identifying the component of shock absorber mechanism. 24). Diagnostic error in the suspension system (corrosion, oil leakage, air leakage, wear, and alignment). 25) repairing suspension system, 12. Check and repair the wheels, tires, and chains: 26) overhaul the wheels, tires, and chain/ gear sets, 13. Repairing the charging system: 27) identifying the components charging system. 28) Error diagnostic in the charging system. 29) repairing the error on the charging system, 14. Repairing the lighting system: 30) identifying the light and load components system, 15. Conducting the starter system: 31) Identifying the starter system component. 32). error diagnostic on the starter system. 33). Repair the error on the starter system, 16. System PGM-FI/ injection: 34). understanding the function of PGM-FI system components. 35). Error diagnostic in PGM-FI system.

4.2 65 Topics/ Sub Topics of The Material Based on The Research Findings:

A. The operation principle of 4-stroke engine motorcycle: 1) understanding the term of TMA & TMB in the machine, 2) understanding the operation principle of 4-stroke engine motorcycle, 3) knowing the difference of 4-stroke and 2-stroke system, 4) knowing the strength and the weakness of 4-stroke engine. B. Motorcycle fuel system: 5) understanding the fuel system, 6). knowing various type of motorcycle carburetor, 7). repairing the error on the fuel system, C. Repairing the engine and its components: 8) identifying the engine types, 9) understanding the engine specifications, 10) identifying the engine components, 11). known the functions and the operation of the engine parts, 12) taking off and assembling the engine components 13) error diagnostic on the engine, 14) understanding the engine adjustment (valve set, spark plug gap, and Sim replacement). D. Conducting a cylinder head and cylinder block overhaul: 15). testing the cracks with the chemical liquids, 16). Fixing the component of cylinder head and cylinder block, E. Repairing the ignition system: 17) identifying the component of ignition system, 18) error diagnostic on the ignition system, 19) repairing ignition system, F. Conducting periodic maintenance of lubrication system: 20) understanding the types of lubrication system, 21) knowing the types of lubricating oil and its viscosity, 22) knowing the ideal distance for oil replacement based on the level of oil/ oil lubricant viscosity. G. Conducting cooling system maintenance: 23). understanding the working principle of water and air cooling system, 24) understanding the types of coolant and its usefulness, 25) understanding the duration of refrigerant usage, 26) repairing the cooling system disorder, H. Repairing the clutch unit and its operating system components (manual & automatic): 27) fixing the damage of the coupling system and its operating components, I. Conducting manual transmission repair 28) repairing the manual transmission system, J. Gear mechanism: 29) understanding gear mechanism components, K. Repairing mechanical starter system: 30) Error Diagnostic on mechanical starter, L. Frame: 31) identifying the frame part type, 32) understanding the frame section specifications, 33). understanding the difference, 34) knowing the part, 35) knowing the function. M. Repairing suspension system/ shock absorbers: 36). knowing the suspensions types, N. Checking and repairing wheels, tires, and chains: 37) identifying the type of tires (outside & inside part) and its specifications, 38) error diagnostic on wheels, tires, and chain drive systems, 39). repairing/ replacing the tubeless tires, O. Repair brake systems (tromol & discs): 40) identifying the brake system components, 41) replacing and installing the brake systems, 42) repairing and adjusting the brake system, 43) understanding the replacement guides, 44) understanding the electrical parts, 45) understanding the electrical parts specifications, 46) understanding the difference of the electrical parts, 47) understanding the electrical parts function 48) knowing the symbols and codes of the electrical system, 49) understanding the connector functions, 50) knowing the connectors types, 51) understanding the circuit series, parallel, combination, P. Repairing lighting system: 52) understanding the electrical diagrams, 53) understanding and memorizing the blink signs of error, 54) soldering, 55) using test lamps, 56). understanding types of bolamp voltages, 57) knowing the use of multitester, Q. PGM-FI system/ injection: 58). understanding components of PGM-FI system, 59) PGM- FI system warranty conditions, 60). memorizing and understanding mile blinking code, 61) understanding the setting of altitude mode. R. Current Motorcycle Technology System: 62) CBS system (Combination Break System), 63) ACG Starter system, 64) ISS (Idling Stop System) system, 65) ESP system (Exchanged Smart Power).

The need analysis in this research is to know the gap between the expectation and the reality in the school & the industry. The competence of vocational education can be effective if the students in the learning process are taught through a real experience to create behavior, thinking and good actions in the work,[11]. Based on that view, the vocational education must create learning conditions in accordance with the real work field and provide learning in accordance with the needs of the world of work to make sure the vocational education students meet the labor market. Vocational education as part of education which makes an individual more employable in one group of occupations the other [5], [2]. The education in the future should have the goals and orientations to socialize people into appropriate attitudes for the world of work, as well as to orientate people to understand the world of employment and to prepare for the choices and transition that they will have to make to entering it, prepare them with specific skills and knowledge to apply in a direct way after becoming employment.

The need analysis findings on the materials of 4-stroke engine tune-up of motorcycle engineering on vocational high school need to be followed up by the school policy maker. The facts and reality show that a lot of material is still not covered all in the syllabus material 4-stroke engine motorcycle tune-up. The immediate evaluation should be made in case of the materials in the school curriculum to avoid the decrease on the students' competence. The development of automotive technology is so rapid that demand the education institution to improve the materials and the learning process aligning with the community needs as well as to improve the competence of vocational high school students.

Based on the research result, it can be concluded that the scope of practice material of 4-stroke engine motorcycle tune-up on the motorcycle engineering of vocational high school in the current curriculum has 35 topics/ sub topics of material while the "very important" and "important" category of the materials is 100 topics/ sub topics. The results of this study indicate that there is a gap between the learning materials in the school with the industrial needs. Therefore, the existing learning material of 4-stroke engine motorcycle tune-up need to be improved to enhance the competence of the vocational students

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CERTIFICATE OF PARTICIPATION

SURYO HARTANTO

For Presenting Research Paper

LEARNING MATERIAL ANALYSIS OF MOTORCYCLE ENGINE TUNE-UP PRACTICE COMPETENCY OF VOCATIONAL HIGH SCHOOL STUDENTS

In

4th ASIA INTERNATIONAL CONFERENCE

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at

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ACADEMIA SOCIETY & INDUSTRY ALLIANCE
TEKNOLOGI MALAYSIA, JOHOR.

Aspek-Aspek Pengembangan Model Pembelajaran Berbasis Lean Untuk Meningkatkan Work *Skills* Siswa Kejuruan
Penelitian Berbasis Kompetensi. Tahun Ke-1 . 2018

Abstrak

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Lulusan pendidikan kejuruan di indikasikan memiliki kompetensi yang rendah, tidak dapat memenuhi pangsa kerja sehingga mengakibatkan banyaknya pengangguran. Kesenjangan keahlian tingkat pendidikan pada dunia kerja sangat jelas terlihat. Siswa lulusan SMK belum memiliki kemampuan dan peluang yang baik untuk mendapatkan pekerjaan yang layak. Untuk mengurangi pengangguran dan kesenjangan serapan tenaga kerja lulusan SMK, diperlukan solusi dengan mengintegrasikan proses pembelajaran SMK dengan pembelajaran berbasis Lean, luaran pembelajaran ini adalah peningkatan work skills siswa SMK.

Tujuan penelitian ini adalah menghasilkan model pembelajaran berbasis Lean untuk meningkatkan work skills siswa kejuruan Teknik Mesin SMK.

Jenis penelitian ini adalah penelitian pengembangan dengan populasi dan sampel siswa kejuruan di Kepulauan Riau pada jurusan Teknik Mesin. Pengembangan dilakukan dengan menggunakan desain Borg dan Gall. Penelitian tahun ke-1 bertujuan mengetahui kebutuhan work skills yang terdiri dari soft skils dan hard skills untuk siswa pendidikan kejuruan teknik mesin, dengan jenis penelitian discriptive kuantitatif menggunakan analisis pendekatan Dacum. Sample penelitian terdiri dari 100 responden, yang terdiri dari praktisi industri, praktisi pendidikan kejuruan, pakar pendidikan kejuruan yang relevan pada teknik mesin. Berdasarkan hasil analisis terdapat 27 jenis soft skills dan 67 jenis work skills SMK Teknik Mesin. Berdasarkan hasil analisis, temuan tersebut akan digunakan sebagai referensi pengembangkan model pembelajaran berbasis lean untuk meningkatkan work skills siswa kejuruan teknik mesin.

Metodologi

Tahun 1.
Deskriptif Kuantitatif dengan pendekatan DACUM

Tujuan

Mengetahui cakupan kebutuhan soft skills dan hard skills untuk siswa SMK untuk meningkatkan kompetensi work skills pada jurusan Teknik Mesin

Hasil

No	Work Skills Faktor Kejuruan Teknik Mesin	
1	Soft Skills	27 Jenis
2	Hard Skills	67 Jenis

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