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Resource-based Learning: A Paradigm Shift in Materials Design

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***Abstract*—This study addresses multiple outcomes, namely process, implications, and possible future directions for developing English for specific purposes (ESP) materials and English learning materials in general, which ponder the dilemmatic issues in education. These are related to the abundance types of learning resources (both static and dynamic) that are sometimes not systematically evaluated and optimally utilized to support learning, the rapid growth of ICTs which at the same time diminishes civilization in human interactions, the emerging digital natives who acquire and process information in a different way, and the lack of coursebooks which integrate various learning resources. To these ends, we developed a model of resource-based learning ESP materials for mechanical engineering, evaluated the developed materials holistically, and considered the feasibility of the developed materials as well as the potential of RBL materials development for other fields. A sample of 92 mechanical engineering college students was involved as the primary data source. Three experts at ESP and materials development, RBL, and mechanical engineering participated in the preliminary field testing. Results suggested that the developed RBL ESP materials were appropriate in terms of curriculum, contents and tasks, instructional and technical design, and the quality of the learning resources.**

Keywords—learning resources, resource-based learning; ICTs in English language learning, materials development; higher education

I. INTRODUCTION

The exponential growth of information and communications technologies (hereafter ICTs) that have become an integral part of human life has dramatically changed the very nature of resources for learning which are no longer the same with those 25 years ago [1], [2], [3], [4]. The metamorphosis of media has engendered the emergence of digital natives who apparently acquire knowledge and process information in a totally different way. Static resources such as thick textbooks, printed dictionaries, classic maps, and encyclopaedias no longer become the ultimate sources of information when the Internet and digital applications offer a great deal of availability, flexibility, manipulability, and shareability. Numerous studies even emphasize that digital natives, particularly higher education students, obtain a significant amount of information from the Internet rather than from their classroom hours [4], [5], [6], [7], [8], [9]. By February 2018, a survey conducted by deKunder at Tilburg University reports that the indexed websites in the world contain at least 4.47 billion pages. This immense amount of information has initialized the conception of resource-based learning.

Resource-based learning was introduced since 1990s in the predigital environment and in the early stage of digital era. It conceptualizes learning as a process which takes into account the importance, availability, types, and quality of resources to support various learning needs [2], [10]. It guides education practitioners to manage various learning resources, by combining the strengths of both static and dynamic resources, to support student learning and to meet learners' different needs. During our English teaching practices, we observe and contend that many English coursebooks which extensively published, particularly in English for specific purposes domain, fail to incorporate various learning resources into a set of flexible, accessible, and shareable learning materials. It is even worse when teachers treat a coursebook as an ultimate teaching and learning resources for an entire academic year. In contrast, the use of ICTs, Technology-Enhanced Learning, MOOC, social media, and the other typical educational technologies which are identified as being at the forefront of discussion does not mean that they are free from problems in terms of complex management systems and the issue of individualism.

The implementation of RBL in teaching and learning practices in higher education institutions seems to be a promising approach to improve student motivation, facilitate independent knowledge construction, and develop critical thinking and problem solving skills [11]. Despite a number of literatures and studies of resource-based learning, they offer little to suggest how this approach should be practically implemented to design a set of learning materials. RBL in the previous works are merely discussed up to the level of teaching technique to improve student learning and information literacy as well as the challenges to be addressed [12], [13], [14], [15], [16], [17], [2]. In this sense, we embrace this gap as a form of a crucial inquiry to address. We, therefore, applied RBL theory into an practical set of ESP learning materials in the form of a coursebook which functions as a guide for both English lecturers and students rather than as an ultimate learning resource. Although the scale of the study was limited in mechanical engineering department, scholars emphasize that RBL suits adult learners at best which also implied that the results of this study could be generalized in some ways.

The rest of this paper is organized as follow: Section II presents literature review. Section III describes proposed research method of this work. Section IV presents the obtained results and following by discussion in section V. Finally, Section VI concludes this work.

II. Literature Review

A. Teaching and Learning Resources (TLRs): Definition and Selection

Hill and Hannafin in [10] define resource as any "media, people, places, or ideas that have the potential to support learning" [10]. Educational Resource Acquisition Consortium or describes TLR as "information represented, accessible or stored in a variety of media and formats, which assists student learning as defined by the learning outcomes of the curriculum" [18]. Kootenay Columbia School District in [15] identifies learning resources as "any person(s) or any material with instructional content or function that is used for formal or informal teaching or learning purposes" [19]. These resources include printed materials, electronic and digital media, library resources, guest speakers, field trips, and the like. Kurdziolek in [16] stated that exemplifies teaching and learning resources such as "physical demonstration aids, students' contextual understanding, teacher subject expertise, and structured organization of materials, ideas and activities" [20]. Everything has a potential to be a teaching and learning resource. It is not only real objects such as printed materials and electronic media but also people, the surroundings, or even abstract things such as teachers' and students' perceptions. Above all, the most important thing for the success of teaching and learning process is not about the quantity of the TLRs but the ability of these TLRs to accommodate learners' different learning styles, level of comprehension, interests, and needs. In other words, TLRs should make learners learn at best.

Teaching and learning resources need to be evaluated and selected before their implementation in the classroom to considerer their availability, adequacy, appropriateness. For that reason, we conducted a careful scrutiny and conceptual analysis of the published literatures of quality principles for selecting TLRs. ERAC (2008) suggests five domains to cover while evaluating both static and dynamic learning resources, namely: (1) curriculum fit, (2) content, (3) instructional design, (4) technical design, and (5) social consideration. We also combined these evaluation criteria with the adaptation of the digital learning resources evaluation criteria suggested by BECTA (2007) [21], Evaluation and Selection of Learning Resources: A Guide (2008) [22], and Norwegian Centre for ICT in Education (2015) [23].

B. Resource-based Learning (RBL): Definition, Significance, and Components

Resource-based learning basically conceptualizes learning as a process which takes into account the importance, availability, types and quality of resources to support various learning needs [2], [10]. RBL promotes learner engagement and active learning for all students with different learning needs and learning styles with well-structured learning goals [24]. It implies that resource-based learning provides a resource-rich environment for students to learn at best at their own speeds and at all times of the day. This strategy works well in classrooms which naturally consist of individuals with different learning needs, learning styles, ages, prior knowledge, levels of comprehension, and interests. The general misconception that educators might have about RBL environment is that it merely emphasizes the procurement of as many resources as possible for learning. Mullan in [12] concludes, "I must be more selective in the provision of the resources. My initial impression that the availability of too many resources may be counter-productive seems to hold true, since so much valuable time was spent browsing".

There are ample studies which raise this issue for educational purposes as they found a range of advantages in it. RBL can develop various information literacy skills and the other social skills in the learning process such as listening, persuading, questioning, sharing and respecting [2]. RBL also works well to train learners' problem-solving and critical thinking skills [10], [25], [12]. Resource-based learning can boost adult learner engagement [16]. The implementation of resource-based learning can also improves the quality of the teaching and learning process as well as students' achievement as they are actively engaged and their creativity and learning enjoyment improved [17], [13]. Resource-based learning is suitable for adult learners since it can improve their learning motivation when they feel they are responsible for the success of their own learning [26]. Resource-based learning can raise learner interest in learning since it utilizes various and mostly dynamic teaching and learning resources and it also allows learners to solve problems based on their real life experience [27]. RBL offers college students with tied schedule possibility simultaneously with flexible learning times particularly to complete assignments [28].

Hill and Hannafin in [10] mention four major components of resource-based learning as follows [10].

1) Resources: Resource becomes the main aspect of resource-based learning. It is categorized into two basic types, namely static resources and dynamic resources. Static resources have more stable contents but the contents can quickly become inaccurate due to rapid changes. Some examples of static resources are textbooks, novels, magazines, encyclopaedias, and newspaper articles. Conversely, dynamic resources commit to continual changes or are updated continuously, such as web-based resources. Humans also belong to dynamic resources since their knowledge and skills develop as they grow up.

2) *Contexts:* Contexts are the settings where learners' understanding is developed. Contexts can be real or virtual. Contexts are distinguished based on their situations and goals. In 'externally directed contexts', teachers decides the settings (real or virtual), supply the problems to solve, meter the pace of resource use, facilitate the interactions and orient learning goals. 'Learner generated contexts' allow learners to establish learning settings, problems, types of resource to utilize, and learning goals based on their unique circumstances or needs. Teacher assistance is provided only if learners request for it rather than being assumed necessary. 'Negotiated contexts' are the combination of externally directed and learner generated contexts. Typically, teachers will provide problems or issues to solve as well as determine learning goals, but learners can negotiate which resources are best suited to the problem or need.

3) Tools: Tools help learners locate, access and manipulate resources as well as interpret and evaluate their

usefulness. They also aid learners to organize and present their understanding in concrete ways.

4) Scaffolds: Scaffolds are the supports of help given initially and will be gradually reduced as learners' understanding develops. The amount and frequency of scaffolds depend on individual learner and problem encountered. Hill and Hannafin in [10] mention four scaffolding mechanisms: (1) Conceptual – guide learners in what to consider, (2) Metacognitive – assist learners to establish what is known and how to think, (3) Procedural – emphasize how to use the features and functions of a given resource, and (4) Strategic – provide alternative approaches to engaging a task as well as provide assistance to identify, select and evaluate information [10].

C. Resource-based Learning in Materials Design

Some considerations in implementing RBL in materials development are quite many. The static and dynamic TLRs need to be selected and evaluated in terms of their compatibility with the syllabus, content, instructional design, technical design, and social consideration [18]. The dynamic resources, particularly the Internet-based resources or learning apps were evaluated, following the quality principles of evaluating digital learning resources proposed BECTA in [21] and Norwegian Centre for ICT in Education in [23] which cover core pedagogic and core design principles.

The other important considerations for learners learning using RBL materials are the nature of the activities, tasks, and feedbacks. Brown and Smith in [24] highlight that students need to be actively engaged with every single activity provided in the RBL materials and each activity should provide opportunities for interaction. In short, RBL materials should make students actively write, think, research, question, review, synthesize, evaluate, analyse, practice, explain, imagine, and propose [28]

While developing resource-based learning materials, we also need to consider some perils to avoid. Brown and Smith in [28] stated that list some risks to keep away from while creating RBL. Firstly, it is a mistake to overload the students with too much material for them to digest. It is better to provide students with slimmed down packages that they can really use. Secondly, the use of expensive media which cannot be easily updated should be avoided. Thirdly, the materials developer should not forget that building human contact through the materials still matters although students are becoming less reliant on teachers for information-giving. Teachers' roles then have shifted into facilitators, motivators, and guides [28].

III. METHOD

The design of this study was research and development, which adapted the stages of R&D proposed Borg and Gall in [29] and Sukmadinata in [30]: needs analysis, planning (syllabus writing), developing preliminary model of the RBL materials, and final product revision based on the results of expert judgments and small scale trout. The participants were 92 second-year students of mechanical engineering department at one of the best state universities in Indonesia (80 males, 12 females). Their age ranged from 18 to 21 years old. For materials evaluation purpose, three experts at materials development and ESP, RBL, and mechanical engineering were involved. In addition, these 92 students also participated to give feedback on the developed materials through a survey. This quantitative study employed three different Likert-scale questionnaires for three stages of the research (needs analysis, expert judgments, final evaluation or trout). The materials evaluation questionnaires with Likert-scale form had four options: 1 = Strongly Disagree, 2 = Disagree, 3= Agree, 4 = Strongly Agree. The data collected, then, were analysed using the following formula proposed in [32].

$$\mathbf{R} = \frac{(Xh - Xl)}{4}$$

R : Range
Xh : the highest score
Xl : the lowest score
4 : Range of Likert-scale (four-point scale)

Using the formula above, it was found that the range is 0.75. So, the category of the score can be described in Table I as follow.

TABLE I. THE DATA SCORE CONVERSION

Scores	Category
3.26 - 4	Very good
2.6 – 3.25	Good
1.76 – 2.5	Poor
1 – 1.75	Very poor

IV. RESULTS

A. Needs Analysis and Planning

The survey in the needs analysis stage attempted to study the mechanical engineering students' target needs and learning needs. The target needs questions covered the details about their needs of English, lacks in English skills, and wants such as materials theme preferences. The learning needs questions focused more on disclosing their learning styles, including the types of gadgets they utilized in their daily life, the learning resources they usually access and the facilities in their campus. In Figure 1 below, we present the representatives of the needs analysis results.

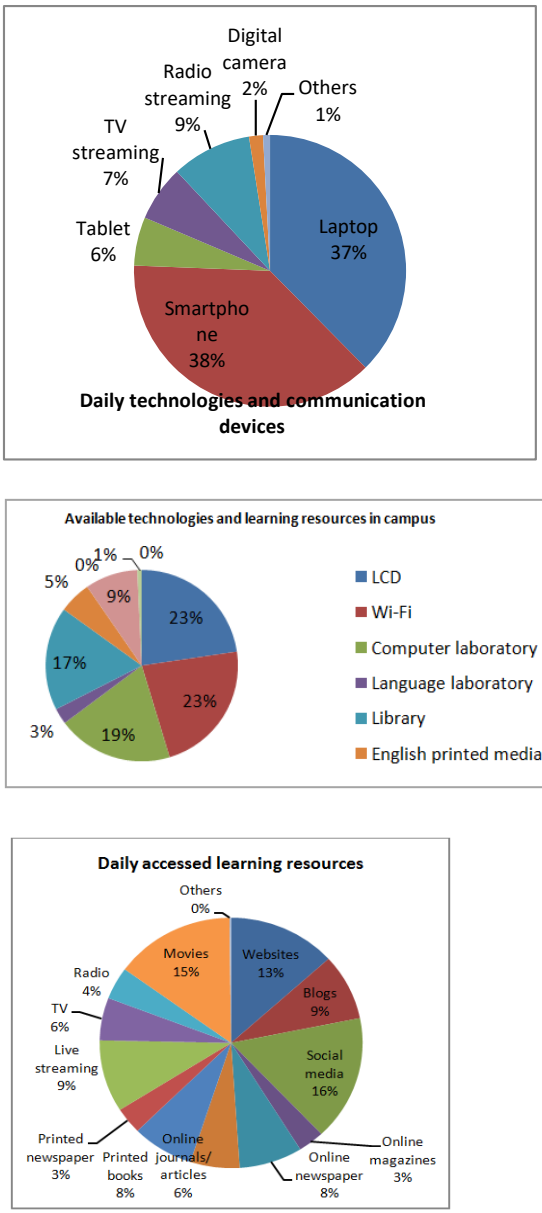

Fig. 1. Representatives of needs analysis results

The syllabus of the resource-based learning materials for mechanical engineering students was generated from the findings of the need's analysis The type of the syllabus chosen was topic-based/theme-based syllabus which suits vocational education better than the other types of syllabus [33], [34], [35]. More specifically, the role of the syllabus in the course design process which was chosen by the materials developer was a skills-centred approach. The main parts of the syllabus were: 1) Unit Title, 2) Basic Competences, 3) Indicators, 4) Learning Materials (Texts and Skills, Language Functions, Grammar, Vocabulary, and Others (related idioms, related cultural focus, and relevant general knowledge or information)), Learning Activities, and Resources and Media. We developed our own unit development framework by combining three related theories (see Figure 2).

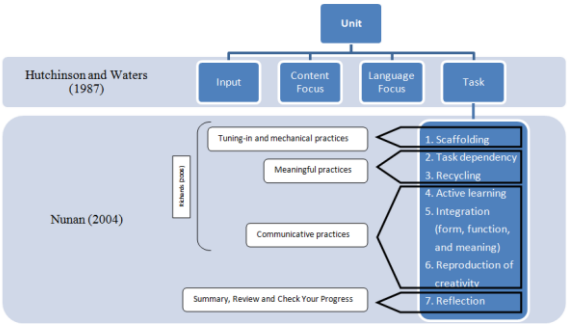

Fig. 2. Unit Development Framework

B. *Expert Judgments and Final Materials Evaluation*

To assess the appropriateness of the developed RBL ESP materials theoretically, three experts helped us. All the six units of the coursebook were evaluated using different questionnaire, yet the same criteria. The evaluation questionnaires were generated from BECTA in [21] Evaluation and Selection of Learning Resources: A Guide (2008), and Norwegian Centre for ICT in Education (2015). The expert judgment results were the basis to revise the first draft of the developed RBL ESP materials before they were used for try-out in the field. At the end of the pilot study of the materials, an evaluation questionnaire was distributed to 92 respondents. By referring to the data score conversion (see Table I), we summarize and present the evaluation results as follow (see Table II).

TABLE II. GENERAL RESULTS EXPERT JUDGMENTS AND USER EVALUATION

Respondents	Mean scores				
	Curriculum Fit	Content and Tasks	Instructional Design	Technical Design	Learning Resources
ESP & materials development expert	4.0	3.98	3.81	3.63	3.86
RBL expert	4.0	3.82	3.73	3.86	3.82
Mechanical engineering expert	3.8	4.0	3.91	3.80	3.92
Students	3.79	3.81	3.88	3.86	3.85
Mean	**3.9**	**3.9**	**3.83**	**3.79**	**3.86**

V. DISCUSSION

With regard to the materials development process, the most fundamental step is identifying learners' needs. The data of specific language and communication skills needed by mechanical engineering students should be gathered and analyzed systematically as it leads to very specific materials [36], [37], [38], [39]. The next stage was constructing the resource-based learning ESP syllabus based on the needs analysis results. We used topic-/theme-based syllabus as it offers higher flexibility. Brown in [24] and Nunan in [29] argue that topic-/theme-based syllabus is more practical for vocational education as it covers both subject-matter knowledge and English learning equally [32], [33]. The

combination of both static and dynamic resources should be taken into account while constructing the syllabus.

The main distinction between the general materials development and this RBL materials development is the extent to which various learning resources were occupied sufficiently but not too much, to support student learning and to meet different needs of learners. Dynamic learning resources utilization, in particular, became our concern. We simply thought if these mechanical engineering students were trained to be the best future technologies, then why they should be restricted from the use of technology in their learning process, not to mention English language learning. Tomlinson in [38] stated that points out that the involvement of technology in language materials development "provides teachers and learners with flexibility and choice … the mobile phone, in particular, as offering great potential for learners (especially in South and South-East Asia where many teenagers have access to mobiles but not to schools)" [37]. Besides that, ICT integration into English materials development allows learners to get more input and enables them to share and recycle their language production easily as well as to get instant, real, and objectives feedback from both the insiders and the outsides [40], [3].

What we have to be aware of during the identification, selection and involvement of teaching and learning resources are their Types, Availability, Quality, and Importance (TAQY). Therefore, we should firstly identify what types of learning resources are provided; what types of technology devices that the students have; what TLR that the students usually access; their appropriateness in regards to students' level of comprehension, cultural values, and the other relevant aspects; and whether these resources are meaningful or not. Another essential consideration is the nature of the learning activities, tasks, meaningful feedback, and meaningful communication or interaction. RBL materials should make students actively write, think, question, review, synthesize, evaluate, analyse, practice, explain, imagine and propose Race in [28]. Brown and Smith [24] suggest some perils to avoid while developing RBL materials. Firstly, it is a mistake to overload the students with too much material for them to digest. It is better to provide students with slimmed down packages that they can really use. Pilot study or materials testing is therefore important to estimate the quantity of materials which students can learn according to their cognitive level. Secondly, the use of expensive media which cannot be easily updated should be avoided. Thirdly, the materials developer should not forget that building human contact through the materials still matters although students are becoming less reliant on teachers for information-giving. Teachers' roles then have shifted into facilitators, motivators, and guides [28].

We always reflect on the results of needs analysis (particularly shown in Figure 1) to decide what TLR to involve and their quantity. In Unit 2 of the RBL ESP materials for mechanical engineering that we developed, entitled Machine Design, for example, we used some static resources such as: audio recordings, a short movie, dialogue manuscripts, engineering textbooks, machine design pictures, and engineering magazines. The dynamic resources are: the students' experience in machine design, machine design websites, Ms. Words Thesaurus, YouTube, classmates, mechanical engineering lecturers, interactive grammar exercise (online), and dictionary application on Smartphones. We also provided QR-codes when it was necessary to search for further relevant info and to get more exercises.

The expert judgment evaluation as well as the trout results showed a satisfying result in which the five evaluation aspects were considered "very good". This implies that the developed RBL ESP materials were appropriate in terms of curriculum, contents and tasks, instructional design, technical design, and TLR. We also split up the evaluation results into two categories and related them to some theories. These are internal evaluation – the information about the internal consistency of the unit design – and external evaluation – a comprehensive external overview of the content of the materials, what they aim to achieve, and what they ask learners to do [3]. The consistency of the unit organization was ensured through unit development framework and expert judgments, while the external evaluation was conducted through a pilot study of the developed materials.

We selected to focus more on mechanical engineering field as by all accounts the literatures state that engineering graduates in many countries have poor communication skills. Some studies were conducted throughout ASEAN countries such as Malaysia [41], Vietnam [42], Thai [43], and Indonesia [44] and in the USA by Donnell, *et al.* [41] which was discussed by American Society for Engineering Education. They review that this disparity happens as the materials that the students lean and perform in college significantly differ from the situations (audiences, purposes, occasions) that engineering graduates will encounter in the real practice in engineering field [45].

Despite our ESP field choice, the chance to develop RBL ESP materials for other disciplines in higher education institutions is widely possible as RBL require complex thinking and technology literacy skills which are owned by adult learners. Our prediction is based on the success stories of RBL implementation in the previous accounts for teaching in psychology [16], economics [11], general science [2], agrarian college, geography [13], education [14], and a variety of courses [15]. However, some considerations need to be taken into account, particularly the users' learning style. Studies in multidiscipline find that the preferred learning style of an individual may have a relationship to the particular disciplinary framework in which the learning is taking place. Fry, *et al.* in [42] stated that consider the clustering and characteristics of disciplinary knowledge, drawing on the 'Kolb-Biglan Classification of Academic Knowledge' and his 'Learning Cycle Theory'. The classification suggests that the preferred learning style might be attributable to a relationship with a particular disciplinary framework [46].

VI. CONCLUSION

In this digital era, the resource for learning is no longer printed books all the time. Students nowadays in general, and people in general acquire a good deal of information from ICT development, particularly the Internet. Materials developers, therefore, should take this issue into their materials design, so that a coursebook later on is not treated as the ultimate learning resource. It should be seen as a guide. The involvement, selection, and appropriate evaluation of various learning resources, both static and

dynamic, should be considered as a new promising paradigm. Guiding students and letting them exploring various learning resources in fact can improve their learning achievement and awareness of their surroundings. Besides, RBL materials also facilitate self-paced learning as they can access more resources and repeat until they totally understand a certain matter. Resource-based learning materials are closely related to the development and the continuous changing of information and technology which are very fast. Therefore, despite their appropriateness as well as their agreeable quality, RBL materials should keep being evaluated (pre-, while-, and post-evaluation) to maintain their usability.

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