

## Chemistry Authentic Learning: Problem Solving in Electrolysis

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**Highlights:** Chemistry authentic learning module aligns well with the needs of today's participatory learners. The challenge is to channel their collaborative abilities and reflective skills into academic pursuits, helping them to develop the problem solving competency. Authentic practice enhances learners' application of higher-order thinking skills to solve real life tasks. School students were exposed to ill-defined electrolysis problems during intervention in order to train them become competent in problem solving process. This approach has integrated problem solving skills, scientific knowledge and authentic practice in order to develop authentic chemistry problem solving competency in learning electrolysis for school learners in general.

**Key words:** *Problem-solving Competency, Authentic Learning Practice, Electrolysis*

### Introduction

Authentic learning for the 21st Century introduced learners to the basic elements of an authentic learning experience. Teachers are encouraged to design activities for learners that match, as nearly as possible, the real-world tasks of professionals in the field. Hence, learners will be competent to solve real life problems, complex, ambiguous, and multifaceted in nature, requiring sustained investigation. The main purpose of this "Chemistry Authentic Learning" module is to provide an alternative instructional approach to improve student's higher order thinking skill (HOTS) in solving the open-ended problems in chemistry. This module aims to guide and lead the educator or teacher to conduct a meaningful, fun-filled and effective way of teaching electrolysis in the authentic environment.

### Background

Authentic learning activity is designed to draw on the existing skills, talents and experiences of learners, building their competency and confidence through participation. The activity is matched to the needs of the new "participatory learner," one whose expectations for active, hands-on involvement in learning have been raised by the proliferation of creative opportunities available through website, social medias etc. Increasingly adept at creating new-media content and evaluating the content of others through blogs, wikis, and social networking sites, incoming school learners are accustomed to working collaboratively and shaping the direction of online communities forged from personal interests. Teachers can channel these creative and collaborative energies into discipline-specific pursuits and help learners develop the higher-order thinking skills they are least likely to acquire on their own. Within the context of real-world challenges, an effective authentic learning exercise will provide guided opportunities for learners to practice the "portable" skills that will serve them well in any professional context.

As per students' performance report in Malaysia national examination, previous research and survey report that electrochemistry is a crucial topic for learners in learning chemistry at secondary school in Malaysia. Electrolysis is a part of learning objective in the chapter of Electrochemistry (Lee, 2008; Lee and Kamisah, 2012, Lartson, 2013). Studies have been carried out and results showed that animation and simulation using Information and Communication Technology (ICT) can help learners to visualize and hence enhance learners' understanding in learning abstract chemistry topics.

Problem solving competency would be developed if learners are able to apply the scientific competencies to solve the open-ended problems in an authentic learning environment. Learners must be equipped with the problem solving skill and should be able to apply it to confront with real-life problems, outside the classroom (Surif et.al,2014). Thus, this "Authentic chemistry learning" was developed for the purpose of promoting the development of problem solving competency in electrolysis by considering learners' scientific knowledge competencies and problem solving skill as their chemistry problem solving competency.

ADDIE Model (Rosett, 1987) was applied in the production of this on-line module. Based on the findings in the preliminary study, researcher will identify the problem underlying factors that influence the development of problem solving among school students. Then, on-line module for learning Chemistry shall be designed for intervention at Full Residential School. Researcher will apply ADDIE model by ADDIE Model ( Roseett, 1987) to design the module. Rationally, ADDIE model is considered as practical and appropriate to be applied due to the five systematic steps. The module is developed based on social constructivism theory because this theory emphasized on collaborative problem solving and authentic learning environment which will enhance the construction of knowledge in the real life situation (Jonassen, 2007). Four identified elements of reflection, ill-defined problem; real life task and collaborative problem solving are fully integrated to design an authentic chemistry learning environment. These type of problems requires the application of higher-order thinking skills not only application of knowledge (Bozi and Tramullas, 2014).

## Objective

This module is designed and developed to achieve some objectives as stated:

1. To improve the learner's problem solving skills to solve open-ended problem in chemistry.
2. To attach learners with real life activities (tasks) in learning electrolysis
3. To encourage the collaborative problem solving to solve open-ended problem in chemistry
4. To develop the reflective practice among learners during solving the problem.
5. To interconnect the learners' scientific knowledge competency with real life problems.

## Impact

Towards meeting the 21<sup>st</sup> Century education requirements and in order to provide world class education in Malaysian context, this module can provide the teacher and educator with practical and updated learning approach to teach chemistry. This online module is a platform for learners to access the real life tasks and solve the ill-defined problems collaboratively. By this way, it provides the opportunity for learners to share the solution or product of problem to others. Due to educational research development to emphasize that higher order thinking skills are important in problem solving task, Malaysian Education Blueprint (2012) has stated one of the key attributes acquired by learners to be globally competitive is thinking skills. Complex real-life problems often required complex solutions that can be obtained through higher thinking processes. Every student will learn how to continue acquiring knowledge throughout their lives and be able to connect different pieces of knowledge to create new knowledge. Activities from this module will improve and equip our learners' problem solving competency for national examination (SPM) and international assessment such as PISA.

This module has been developed to overcome a few issues and give an impact to the teachers and learners. Most of the learners shared their positive feedback from the interview conducted and participant's grid reflection responses. Learners can do the reflection immediately at the end of the lesson. This reflection is an effective self-assessment for participant and teacher to evaluate the learning process and outcomes. Real life task assigned to the participants are assessable at any time and place as long the internet service is available. Participants were inspiring to participate in the activity provided in the on line module as they are able to hands- on and mind- on. The ill-defined problems in the real life tasks assigned for the learners become the challenge for them to solve based on their scientific knowledge, prior experience and problem solving skills. Learners can watch the animation, video and graphic image to understand the concepts of electrolysis in a deep way. Learners have an opportunity to conduct the forum with the expert to solve the real life task about an environmental issue.

Teacher as the facilitator found that this module is a systematic approach to teach chemistry. Facilitator can plan and update the lesson more conveniently with the help of activities and resources provided. The resources for learning electrolysis become multi-perspective. Facilitator can keep track and receive the submission of assignment more systematic. It is easy to analyse and summarize the response from grid reflection.

This on-line learning module has been used as a tool to provide the users with learning material, virtual laboratory, enrichment activity and quiz supported by multimedia elements such as video, audio and animations to engage student with a real life of learning environment. This "Authentic Chemistry Learning" presents the approach on how teachers have used technology to foster authentic learning to improve problem solving competency among school learners. In this "Authentic Chemistry Learning", problem solving competency is an integration of scientific

knowledge and problem-solving skills that can be measured during the process in solving open-ended electrolysis problem based on learners' actual performance.

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