

**TEACHING COLLOIDS: HANDS-ON ACTIVITY LEARNING
UNIT TO ENHANCE STUDENTS' UNDERSTANDING ON THE
EFFECT OF PARTICLE SIZE IN SOLUTION**



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**A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER IN SCIENCE
(SCIENCE AND TECHNOLOGY EDUCATION)
FACULTY OF GRADUATE STUDIES
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Understanding the role played by size of the particles is very important as manipulation of such materials in a nanoscale has brought wider societal implications. Such technology has touched our life and it is therefore vital for our students to at least have some awareness of such an emerging field. Teaching of concepts in this field is popular in colleges and the need of infusion is felt at the school level also. However, the Bhutanese curriculum is still in its infancy and availability of technologies and equipment are difficult and expensive. However, the colloid concept under the science curriculum of grade XI-XII chemistry provides an opportunity for the students to explore and relate the effect of size of particles by relating to the scattering of light. Since most of the teachings in Bhutanese classrooms are dominated by traditional style, the use of active hands-on learning involving more of an inquiry approach is recommended. In addition, studies show that the hands-on activity and inquiry lab as an effective drive for learning chemistry. Therefore, a hands-on activity learning unit based on the inquiry lab learning approach was designed to help students understand about the effect of size of particles in the solution through the teaching of colloid concept and also to see their perception towards the learning unit.

One group pretest-posttest design was implemented to 43 grade XI science students in one of the schools located in the southeastern region of Bhutan. The whole activities of the learning unit are encapsulated into two lessons for enhancing students' understanding about the effect of size of particles. The guided inquiry lesson includes activities to differentiate solution, suspension and colloids through the properties of filterability, homogeneity, gravitational, the Tyndall effect and appearance. The structured inquiry lesson involves the preparation of colloids through the sol-gel process with the use of LED laser to understand about the nanoparticle and the scattering by nanoparticles. A Total of five instruments were used to collect data through the implementation of teacher-designed activities. The data from the colloidal achievement test, students' reflection, perception questionnaire, semi-structured interview and students' document show enhancement of students' understanding of the effect of particle size in the solution and positive perception towards the learning unit. The results also show some challenges and difficulties which students faced due to little or lack of experience learning from such an approach. Some of the key points expressed by the students like laboratory experience, new learning approach, tools and materials, interest, group work and time issues are discussed along with its implication and limitation.

**KEY WORDS: PARTICLE SIZE / INQUIRY LAB / HANDS-ON ACTIVITY / COLLOIDS / LIGHT
SCATTERING / TEACHING NANOSCIENCE**

166 pages