

EXAMINING THE PEDAGOGICAL CONTENT KNOWLEDGE AND PRACTICE OF
EXPERIENCED SECONDARY BIOLOGY TEACHERS
FOR TEACHING DIFFUSION AND OSMOSIS

Deanna M. Lankford

Dr. Patricia M. Friedrichsen, Dissertation Supervisor

ABSTRACT

Teachers are the most important factor in student learning (National Research Council, 1996); yet little is known about the specialized knowledge held by experienced teachers. The purpose of this study was twofold: first, to make explicit the pedagogical content knowledge (PCK) for teaching diffusion and osmosis held by experienced biology teachers and, second, to reveal how topic-specific PCK informs teacher practice. The Magnusson et al. (1999) PCK model served as the theoretical framework for the study. The overarching research question was: When teaching lessons on osmosis and diffusion, how do experienced biology teachers draw upon their topic-specific pedagogical content knowledge? Data sources included observations of two consecutive lessons, three semi-structured interviews, lesson plans, and student handouts.

Data analysis indicated five of the six teachers held a constructivist orientation to science teaching and engaged students in explorations of diffusion and osmosis prior to introducing the concepts to students. Explanations for diffusion and osmosis were based upon students' observations and experiences during explorations. All six teachers used representations at the molecular, cellular, and plant organ levels to serve as foci for explorations of diffusion and osmosis. Three potential learning difficulties identified by the teachers included: (a) understanding vocabulary terms, (b) predicting the direction of osmosis, and (c) identifying random molecular motion as the driving force for diffusion and osmosis. Participants used

student predictions as formative assessments to reveal misconceptions before instruction and evaluate conceptual understanding during instruction. This study includes implications for teacher preparation, research, and policy.