This study investigates the development of prospective mathematics teachers’ use of multiple representations during teaching in technology-rich environments. Forty prospective teachers took part in a teacher preparation programme which aims to develop technological pedagogical content knowledge (TPCK). As part of this programme, prospective teachers participated in workshops during which the TPCK framework was introduced focusing on function and derivative concepts. Various components of TPCK were considered. This study investigates one particular component of TPCK: knowledge of using multiple representations of a particular topic with technology. The content we focus on in this paper is “radian concept”. Two out of forty prospective teachers introduced the radian concept as part of their micro-teaching activities. The data obtained from semi-structured interviews, videos of prospective teachers’ lessons, their lessons plans and teaching notes was analysed to investigate prospective teachers’ knowledge of representations and of connections established among representations using technological tools such as Geogebra and Graphic Calculus software. We use the framework of “functional taxonomy of multiple representations” which differentiates three main functions that multiple representations serve in learning situations: to complement, constrain and construct. We discuss the educational implications of the study in designing and conducting teacher preparation programmes related to the successful integration of technology in teaching mathematics.