The interaction between moving dislocations and nanometer-sized radiation defect clusters controls the yield strength, ductility and flow localization behavior of structural materials under irradiation. To understand plastic deformation processes in body centered cubic (BCC) Mo, molecular Dynamics (MD) and molecular statics (MS) simulations have been performed. Considering the unique non-planar core structures of BCC screw dislocation, we first report the behavior of screw dislocation motion as a function of temperature and applied shear stress. A transition from smooth to rough motion of the screw dislocation is observed with increasing shear stress. The double kink nucleation and migration occurs in the smooth motion regime while interstitial clusters, prismatic dislocation loops, and vacancies are produced in the rough motion regime. As well, the screw dislocation glide plane is observed to change from {110} to {112} with increasing temperature. Then, we introduce the commonly observed radiation obstacles into the system and observe their interaction behavior with screw dislocations in both dynamic and static conditions. The initial results indicate that the screw dislocation interaction with void occurs via a simple shear mechanism, which shears the void by one Burgers vector per each passage. However, the obstacle strength calculated from molecular statics (MS) calculations of the energetics of the interaction shows a large increase in critical resolved shear stress for void diameter larger than about 3 nm.