Refrigerant blends containing hydrofluoroolefins are becoming of great interest as replacement fluids for air conditioning and refrigeration systems, and organic Rankine cycle power systems. Today, different blends of hydrofluoroolefins with hydrofluorocarbons or natural refrigerants (e.g., hydrocarbons, carbon dioxide) are studied in order to improve the safety or performance features of the replacement fluids. The lack of experimental data for these fluids impedes the development of accurate mixing models for Helmholtz-based equations of state. In this work a new mixing model for the study of hydrofluoroolefin blends by using a modified Peng-Robinson equation of state is presented. The mixture parameters were fitted based on experimental vapor-liquid-equilibria data of several hydrofluoroolefin blends. The predictive performance of the new model was compared with that of the standard Peng-Robinson equation of state and the fluid-specific Helmholtz-based models. The optimized binary interaction parameters improved significantly the predictions of saturated pressures for mixtures of hydrofluoroolefins and hydrocarbons.