We construct (almost) holomorphic modular forms by considering theta series for quadratic forms of signature $(n-1, 1)$. In order to do so, we generalize Sander Zwegers' former construction by including homogeneous and spherical polynomials in the definition of the theta series. For the (almost) holomorphic and the modular theta series obtained this way, we give a criterion for these series to coincide. Finally, we also provide some explicit examples. This is joint work with Sander Zwegers.