

## Final Design Report for the Piano Pedal Pusher Project

The final product was delivered in 2017 and was very well received and publicized. See the [VIDEO](#) page for more information!

Heidi is a young piano player with congenital amputations at both knees and both elbows. She became frustrated with not being able to reach the piano pedals, she reached out to KU. A team of four undergraduate engineering students took on the challenge to design and build a device that would allow her the ability to use the piano pedals as she plays.

The team came up with two possible designs for the piano pedal pusher. These two designs were developed into two functioning prototypes.

The first prototype device will be referred as to the “rod design.” The length of the rod is adjustable. This design was created with the idea of mimicking the motion of a human ankle/foot pressing down a pedal. This device is composed of a rod that is connected at the top end to a strap secured around Heidi’s thigh and connected at the base end to a clamp-like-device. This base part of the device has a slab that sits on the floor beneath the pedal to provide stabilization and one slab that sits above the pedal. The top slab is connected to the bottom slab at a joint with a compression spring to keep it from clamping or pressing the pedal down prematurely. Because of the compression spring, Heidi is able to rest her leg’s weight on the device without it pressing the pedal prematurely.



Fig. 1. Students assemble the rod pusher (left) and Heidi uses it playing (right).

The other prototype device is a pulley system that presses the pedal down as Heidi lifts her leg. It has a box that fits over a single piano pedal. The box has a bar that pushes on the pedal, set of cords, and a pulley system. The cords are attached to the

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bar at one end, run through a pulley, and are attached to a strap that is secured around Heidi's thigh. The idea behind this design was that the resting position of Heidi's leg would be on the bench, so she would pull up with her leg to press the pedal down. This was thought to be an advantage because she wouldn't have to hold her leg up in the air between each pressing of the pedal. However, even though the device worked great from a functional standpoint, the action proved to be unnatural for Heidi as she had always not only watched other piano players press down to use the pedals, but had also been trying different approaches to press down on the pedal as well.



Fig. 2. Student attaches pulley lines to leg cuff (left) and Heidi plays using the pulley system pedal pusher (right). The student holds the pusher box down for the prototype, but this would be resisted by an extension to the keyboard.

Both devices were designed with the ability to adjust accordingly as Heidi continues to grow. They were also both designed to be portable so that they could be transferred from her home to her piano lessons or to her recitals. The ability for Heidi to be able to transport and set up the device with minimal assistance was also taken into account for both device designs.

The rod design is the device we have chosen to move forward with in manufacturing the final product. Heidi was able to operate this device much more naturally and

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was able to incorporate it into her piano playing almost immediately upon trying it, while the pulley system device was more difficult for her to operate. The rod height adjustment mechanism is also simpler to operate and quicker to adjust allowing Heidi to more immediately adjust it for factors other than growth, such as a difference in piano bench height. The rod design is also easier for Heidi to transport herself as well as simpler for her to set up with minimal assistance.

The final product was produced in aluminum and delivered in Fall of 2017! Heidi was very happy with the new piano pedal pusher and quickly learned how to use it!!! She has been inspired to play the piano more and is really enjoying her new sound!

