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Respiratory Training Device
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6.5 University of Minnesota Medical Center

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6.7 Vanderbilt University Medical Center

6.8 UTMB, The University of Texas

6.9 American Thoracic Society

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1 BREATHING DYNAMICS

- Fast and intense breathing shows distress, panic, fear or hostility, while slow breathing shows a state of relaxation.

- Open mouth makes breathing worse as it does not allow an efficient exhalation. The most efficient exhalation (most air is released from the body) is through semi-closed lips (it is also much more efficient than exhalation through nose alone).

- Most people keep air trapped inside, not allowing for new air to enter. Such “breath holding” behaviour is inefficient in terms of gas exchange and thus leads to faster and more intense breathing.

- In asthma (and other respiratory obstructions) airways sometimes collapse making it even more difficult to breathe. Such a collapse can be prevented by exhaling against the resistance of pursed lips, a technique commonly known as “Pursed Lip Breathing”.

- Breathing is the only autonomous function that we can control consciously, therefore it provides a way to regulate our autonomous body processes such as heart rate, digestion and endocrine glands.

- Breathing affects heart rate in such a way that each inhalation speeds up the heart, while each exhalation slows it down, this phenomena is observed as “Heart Rate Variability” and is commonly explained as “Respiratory Sinus Arrhythmia”.

- When exposed to stress, humans inhale air in order to prepare for a “fight or flight” activity. It speeds up heart rate and starts secretion of stress hormones such as cortisol and epinephrine.

- People who breathe fast often overeat. Breathing more slowly reduces your appetite. making exhalations longer is also known to improve digestion and is being used as a “Long Breath Diet” in Japan and many other countries.
2 BREATHING PROBLEMS

2.1 Shortness of breath

Difficulty in breathing (also known as shortness of breath, breathlessness, or dyspnea) is the result of inefficient breathing. In one’s lifetime, one may experience rare episodes of shortness of breath as part of high levels of activity like exhaustive exertion, or during environmental conditions such as high altitude or very warm or cold temperatures. Other than these extreme conditions, shortness of breath is commonly a sign of a medical problem. Some of the causes of shortness of breath are asthma, bronchitis, tuberculosis, COPD and emphysema. These problems can be treated with breathing exercises such as Pursed Lip Breathing.¹

2.2 Asthma and COPD

Asthma is most common chronic disease among children, and affects more than 253 million people around the world. Pursed lip breathing is most recommended to manage asthma and COPD as it makes breathing more efficient, improves oxygenation and reduces breathing rate². Additionally Pursed Lip Breathing is recommended during an asthma attack by most asthma specialist organisations worldwide.³ ⁴ ⁵.

2.3 Emphysema

In emphysema the alveoli and lung tissue are destroyed. With this damage, the alveoli cannot support the bronchial tubes. Consequently the airway collapses which causes an “obstruction” (a blockage), which traps air inside the lungs. Too much air trapped in the lungs can give some patients a barrel-chested appearance. Pursed Lip Breathing helps emphysema sufferers exhale more efficiently and allows them to prevent airway collapse by maintaining a positive pressure inside airways.

2.4 Stress and Anxiety

The stress response can be viewed as an interactional process that causes psychophysiologic reactions that are immediate and can occur up to and including physiologic events 3 weeks after confrontation with the stressor. Pursed lip breathing helps in coping with stress and anxiety related disorders. It can be used as a 10-20 minutes daily systematic respiratory exercise to train breathing in combination with other rehabilitative activities.

2.5 Attention Deficit Disorder

Attention deficit hyperactivity disorder (ADHD, similar to hyperkinetic disorder in the ICD-10) is a developmental neuropsychiatric disorder in which there are significant problems with executive functions (e.g., attentional control and inhibitory control) that cause attention deficits, hyperactivity, or impulsiveness which is not appropriate for a person's age. ADHD usually appears first in childhood, but can also now be diagnosed in adults (as long as some symptoms were present in the individual's childhood, but simply never diagnosed). Breathing exercises have been recommended to patients suffering from ADHD.

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2.6 Speech Disorders

Speech disorders or speech impediments are a type of communication disorder where 'normal' speech is disrupted. This can mean stuttering, lisps, etc. Someone who is unable to speak due to a speech disorder is considered mute. In many cases the cause is unknown. However, there are various known causes of speech impediments, such as "hearing loss, neurological disorders, brain injury, intellectual disability, drug abuse, physical impairments such as Cleft lip and palate, and vocal abuse or misuse." As speech is fundamentally linked to breathing, breathing exercises act as a basis to good articulation, projection and tone.  

10 "Speech and Language Disorders and Diseases." 2003. 9 Apr. 2015
<http://www.asha.org/public/speech/disorders/>
3 TREATMENT AND PREVENTION

3.1 Breathing exercises

Poor breathing, either induced by asthma, stress or lack of exercise, affects us. Lack of oxygen in the blood makes us feeling unfocused. Inefficient breathing is also wasteful in terms of energy consumption and thus we feel tired. We go for a gym or walk to get few breaths out but either than that we just feel sort of down through the day. It is crucial for us to improve our breathing in order to achieve better health and better performance.

3.2 Pursed Lip Breathing

Pursed Lip Breathing (PLB) is a breathing technique that aims to make exhalations longer and more efficient, PLB helps people cope with asthma, COPD, emphysema, and stress related disorders. It is described in the American Thoracic Society guidelines as ‘a nasal inspiration followed by expiratory blowing against partially closed lips, avoiding forceful exhalation’. PLB reduces breathing rate, helps make exhalation more efficient, reduces dyspnoea (shortness of breath), and improves cellular oxygenation. PLB is gaining recognition in medical community since mid 60s when its positive effects had been first observed. Today there are over 2000 articles indexed in google scholar, pubmed and similar medical databases describing its clinical benefits. According to Cleveland Clinic\(^1\), its effects as are:

- Improves ventilation
- Releases trapped air in the lungs
- Keeps the airways open longer and decreases the work of breathing
- Prolongs exhalation to slow the breathing rate
- Improves breathing patterns by moving old air out of the lungs
- Relieves shortness of breath
- Causes general relaxation

\(^1\) "Pursed Lip Breathing - Cleveland Clinic." 2014. 9 Apr. 2015
<http://my.clevelandclinic.org/health/diseases_conditions/hic_Understanding_COPD/hic_Pulmonary_Rehabilitation_Is_it_for_You/hic_Pursed_Lip_Breathing>
3.3 Technology Review

Technology for breathing exercises range in respiratory detection principles, biofeedback principles and its methods of operation (Table 1).

**Table 1: Review of technology for breathing exercises**

<table>
<thead>
<tr>
<th>Device</th>
<th>Respiratory Detection System</th>
<th>Description</th>
<th>Advantages and Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESPeRATE device</td>
<td>Mechanic principle (expansion detection)</td>
<td>-Non-drug therapy</td>
<td>✔ Guidance provided</td>
</tr>
<tr>
<td>InterCure Ltd.</td>
<td></td>
<td>-Guidance system: visual</td>
<td>✗ Does not require exhalation against pressure, therefore it is less beneficiary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-For the treatment of high blood pressure</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Portable computerized device</td>
<td></td>
</tr>
<tr>
<td>HFCWO Device</td>
<td>Mechanic principle (expansion detection)</td>
<td>-High Frequency Chest Wall Oscillation device</td>
<td>✔ Therapy session lasts about 30 minutes</td>
</tr>
<tr>
<td>Electromed</td>
<td></td>
<td>-Guidance system: N/A</td>
<td>✗ Not entertaining</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Positive pressure air pulses are applied to chest wall</td>
<td></td>
</tr>
<tr>
<td>OHFO device</td>
<td>Pneumatic principle (using mouth to force air into device)</td>
<td>-Oral High Frequency Oscillation</td>
<td>✗ Used only in USA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Guidance system: N/A</td>
<td>✗ Not entertaining</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Developed from the technique of high frequency jet ventilation</td>
<td>✗ Unhygienic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Provides a practical and simple method supplementing breathing in conscious subject</td>
<td></td>
</tr>
<tr>
<td>IPV device</td>
<td>Pneumatic principle (using mouth to force air into device)</td>
<td>-Intrapulmonary Percussive Ventilation</td>
<td>✗ Unhygienic</td>
</tr>
<tr>
<td>Percussionaire Corp.</td>
<td></td>
<td>-Guidance system: N/A</td>
<td>✗ Not entertaining</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Utilizes high frequency</td>
<td></td>
</tr>
<tr>
<td>Device Name</td>
<td>Description</td>
<td>Benefits</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td><strong>Acapella by Smiths Med</strong></td>
<td>Pneumatic principle (using mouth to force air into device)</td>
<td>Combines aerosol inhalation and internal thoracic percussion applies via mouthpiece</td>
<td>✔ Allows inhalation and exhalation without removing from mouth</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Combines the benefits of both PEP therapy and airway vibrations</td>
<td>✗ Unhygienic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Guidance system: N/A</td>
<td>✗ Not entertaining</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improves clearance of secretions</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Can accommodate virtually any patient’s capacity</td>
<td></td>
</tr>
<tr>
<td><strong>Cornet device by R. Cegla GmbH &amp; Co. KG</strong></td>
<td>Pneumatic principle (using mouth to force air into device)</td>
<td>Adapter with mouthpiece</td>
<td>✗ Unhygienic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Guidance system: N/A</td>
<td>✗ Not entertaining</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduces unproductive cough</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increases the vital capacity</td>
<td></td>
</tr>
<tr>
<td><strong>Flutter by Aptalis Pharma US, Inc.</strong></td>
<td>Pneumatic principle (using mouth to force air into device)</td>
<td>Mucus Clearance Device</td>
<td>✗ Unhygienic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Guidance system: audio</td>
<td>✗ For single patient use only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provides PEP</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Ability to vibrate the airways, intermittently increase endobronchial pressure, accelerate expiratory airflow</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Changing inclinations makes higher or lower frequency</td>
<td></td>
</tr>
<tr>
<td><strong>Frolov breathing Dinamika Ltd., Russia</strong></td>
<td>Pneumatic principle (using mouth to force air into device)</td>
<td>A type of intermittent hypercapnic hypoxic breathing training</td>
<td>✗ Unhygienic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Guidance system: visual</td>
<td>✗ Not entertaining</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exposure to the short-term hypoxia (the state of oxygen deficiency)</td>
<td></td>
</tr>
<tr>
<td>Device</td>
<td>Description</td>
<td>Pros</td>
<td>Cons</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Powerlung by PowerLung Inc.</td>
<td><em>Pneumatic principle (using mouth to force air into device)</em></td>
<td>- Strength training techniques</td>
<td>✗ Unhygienic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Guidance system: N/A</td>
<td>✗ Not entertaining</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Expanding lung capacity</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Different models</td>
<td></td>
</tr>
<tr>
<td>Spiro-Ball by Leventon Barcelona (Werfen Group Corporation)</td>
<td><em>Pneumatic principle (using mouth to force air into device)</em></td>
<td>- Volumetric/Spirometric Exerciser</td>
<td>✓ Easy usage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Guidance system: visual</td>
<td>✗ Unhygienic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Shows inspiratory volume</td>
<td>✗ Not entertaining</td>
</tr>
<tr>
<td>Three-ball by Leventon Barcelona (Werfen Group Corporation)</td>
<td><em>Pneumatic principle (using mouth to force air into device)</em></td>
<td>- Restores and maintains lung capacity</td>
<td>✓ Easy usage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Guidance system: visual??</td>
<td>✗ Unhygienic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Enhances inspiratory and expiratory muscle</td>
<td>✗ Not entertaining</td>
</tr>
<tr>
<td>Threshold PEEP/IMT Respironics Inc. Health</td>
<td><em>Pneumatic principle (using mouth to force air into device)</em></td>
<td>PEEP</td>
<td>✓ Promotes effective breathing patterns improving gas exchange and central and peripheral airway function.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Designed for therapy with positive expiratory pressure</td>
<td>✗ It is only meant for expiratory exercise</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Guidance system: N/A</td>
<td>✗ Unhygienic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- PEEP therapy helps reducing the amount of gas that is trapped in the lungs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Resistance is provided by a spring-loaded valve</td>
<td>✗ Not entertaining</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Forced pressure opens the airways and mobilizes secretion</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IMT</td>
<td>✓ Increases respiratory muscle strength and endurance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓ Increases exercise tolerance</td>
</tr>
<tr>
<td>Company</td>
<td>Principle</td>
<td>Features</td>
<td>Notes</td>
</tr>
<tr>
<td>-------------------------</td>
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<td>--------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>RFB micro biofeedback</td>
<td>Pneumatic principle (using mouth to force air into device)</td>
<td>- Provides consistent and specific pressure inspiratory muscle strength and endurance training</td>
<td>× Effects of IMT have not been adequately tested&lt;br&gt;× Only meant to be used as an inspiratory exercise</td>
</tr>
<tr>
<td>BioMental GmbH</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-330 C2 by J&amp;J engineering</td>
<td>Mechanic principle (measuring lung expansion)</td>
<td>- For functional disturbances of heart and cycle&lt;br&gt;- Guidance system: visual, audio&lt;br&gt;- Influence on blood pressure</td>
<td>× Difficult to use&lt;br&gt;× Very expensive</td>
</tr>
<tr>
<td>Pulmonica by Harmonica Tech</td>
<td>Pneumatic principle (using mouth to force air into device)</td>
<td>- It produces deep, resonant, meditative sounds that can be felt vibrating in the lungs and sinuses&lt;br&gt;- Guidance system: N/A&lt;br&gt;- It is meant to promote airway clearance, oxygenation and strengthening of respiratory muscles</td>
<td>✔ Usage does not require musical skill&lt;br&gt;✔ Activation of diaphragmatic breathing&lt;br&gt;× Forcing air&lt;br&gt;× Detaining water inside during usage&lt;br&gt;× Unhygienic</td>
</tr>
<tr>
<td>Alvio by Alvio</td>
<td>Pneumatic principle (using mouth to force air into device)</td>
<td>- An all-in-one breathing trainer, symptom tracker and mobile game controller&lt;br&gt;- Guidance system: visual&lt;br&gt;- Controlling a video game on a smartphone/tablet</td>
<td>✔ Wirelessly communication with phones/tablets&lt;br&gt;✔ Cloud sharing information&lt;br&gt;× Forcing air&lt;br&gt;× Unhygienic&lt;br&gt;× Danger for open mouth breathing</td>
</tr>
<tr>
<td>Brand</td>
<td>Pneumatic principle (using mouth to force air into device)</td>
<td>Benefits/Features</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td></td>
</tr>
</tbody>
</table>
| Respi by Respio  | Pneumatic principle (using mouth to force air into device) | -For preventing or reducing asthma attacks  
- Guidance system: visual  
- Disposable mouth tube  
- Proper body posture with smartphone sensors  
- GPS for ascertaining dangerous areas asthmatics  
- Analyzed data sent to physicians  |
|                  |                                                            | ✓ Linked to smart phone  
✓ Hygienic  
✗ Forcing air  
✗ No positive side effects (relaxation, longer exhalation) |
| Zenytime by Zenytime | Pneumatic principle (using mouth to force air into device) | -For promoting deep, rhythmic breathing to increase oxygen levels  
- Guidance System: visual  
- Scientifically engineered  
- Comes with an application  
- Sharing experiences on social media  
- Dongle is connected with bluetooth  |
|                  |                                                            | ✓ Lightweight dongle  
✗ Unhygienic use (you hold dongle with hands)  
✗ Water collecting on the device |
| My Spiroo by My Spiroo | Pneumatic principle (using mouth to force air into device) | Mobile spirometer  
- Guidance System: visual  
- Connected, ultraportable peak flow meter  
- Measures how much air is passing out of users' lung  
- My Spiroo Pro: version for doctors to patients data  
- My Spiroo Home: version for patients  |
|                  |                                                            | ✓ For assessing what is causing a bronchial flare-up  
✗ Unhygienic |
| Sensawaft by Zyxio | Pneumatic principle (using mouth to force air into device) | -For disabled people or hands-free mobile phone makers  
- Guidance system: visual  |
|                  |                                                            | ✓ Chipset can be integrated into hardware (mp3 players, phones, laptops)  
✓ Fun |
<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Talk by Arsh Shah Dilbagi</strong>&lt;br&gt;Pneumatic principle (using mouth to force air into device)&lt;br&gt;- Senses pressure variations from the chip which user exhales</td>
<td>- Exhales with varying intensities for converting them into electrical signals&lt;br&gt;- Guidance system: visual&lt;br&gt;- Signals processed by microprocessor (Morse engine)&lt;br&gt;- Morse code: converting signals into words</td>
<td>✔ For people with developmental disabilities&lt;br&gt;✘ Not entertaining&lt;br&gt;✘ Non-medical purpose (does not describe how people improve breathing)</td>
<td>✗ Dizziness if one breaths incorrectly</td>
</tr>
<tr>
<td><strong>Powerbreathe</strong>&lt;br&gt;Powerbreathe</td>
<td><strong>Pneumatic principle (using mouth to force air into device)</strong>&lt;br&gt;- Inspiratory Muscle Trainer&lt;br&gt;- Guidance system: N/A&lt;br&gt;- For strengthening the muscles we use to breathe&lt;br&gt;- Optimisation of airflow&lt;br&gt;- 3 variable resistance levels</td>
<td>✔ Suitable for beginners&lt;br&gt;✘ Not entertaining&lt;br&gt;✘ Mostly designed for athletes</td>
<td></td>
</tr>
<tr>
<td><strong>BREATHING+</strong>&lt;br&gt;BreathingLabs</td>
<td>Non-contact/pneumatic principle (using mouth to air into device)&lt;br&gt;- Making exhalations longer and more efficient&lt;br&gt;- Guidance system: Visual and auditory&lt;br&gt;- Operates on Android, iOS, Windows and devices&lt;br&gt;- Includes numerous “breathing games” accessibility tools for pulmonary rehabilitation&lt;br&gt;- Clinically tested “Pursed Lip Breathing” technique</td>
<td>✔ Fun, entertaining&lt;br&gt;✔ Medical purpose&lt;br&gt;✔ Non-contact operation&lt;br&gt;✔ Realtime feedback&lt;br&gt;✔ Progress tracking</td>
<td>✗ Does not operate standalone, requires phone or computer to operate</td>
</tr>
</tbody>
</table>
4 OUR PRODUCTS

4.1 Breathing Games

Breathing games are based on a breathing technique called Pursed Lip Breathing and they are designed to train kids to exhale longer. Breathing games run on computers and mobile devices. Breathing guidance is being provided and breathing rate is being monitored.

4.2 Breathing Toys

Breathing Toys are electronic toys that are played with your breathing exercise implementation and offer the excitement of real life interaction of several players.

4.3 Breathing Video

Breathing Video is a tool to improve breathing by watching television. It is designed to most efficiently reduce users' breathing rate. It does so by synchronising video content with the act of exhaling through pursed lips. It has been tested against the control group and it showed a consistent improvement in breathing rate reduction in less than 5 minutes of use.

4.4 Breathing Scrolling

Breathing Scrolling is a new healthy way to scroll websites or pdf documents - without using computer mouse or keyboard. Just blow into the headset to scroll any website or pdf document. Scrolling speed can be adjusted to your preference. Breathing scrolling is available as a Chrome extension on Google Chrome browser or as a bookmarklet that can be easily dragged and dropped into bookmarks bar in other web browser.
4.5 Breathing Headset

BREATHING+ headset is built out of soft and comfortable polyethylene plastic. It is adjustable for different head sizes, durable and washable. It is designed to provide maximum comfort and best possible PLB detection in a quiet or loud environment. Additionally, BREATHING+ headset provides hands-free operation, firm position in front of mouth and a superb signal-to-noise ratio resulting in the most accurate breathing detection.

4.6 Breathing Package

BREATHING+ package is a complete solution that turns your desktop computer and/or mobile phone into a fun interactive breathing exercises gaming system. BREATHING+ is already being used in clinical environments to manage asthma, COPD, postoperative rehabilitation, stress and anxiety. Now you can use this technology in your home to play breathing games and efficiently improve your breathing. It's a new kind of fitness, it's "pilates" of the next century!
5 ADVANTAGES

5.1 Comparison with other technology for breathing exercises (table 1)

- Blowing air into the mouthpiece does not require a physical contact with users' mouth or lips, therefore it provides less possibilities for infection.

- It is not required to use tubes or pipes to achieve resistance during exhalation as kids eventually learn to provide such a resistance by exhaling through pursed lips.

- Breathing games provide an enhanced motivation and lead to a more efficient learning process that keeps kids entertained and motivated as they grow.

- Audio feedback allows kids to perform exercises with their eyes closed, resulting in a more relaxing experience.

- Breathing games make kids track their breathing progress which improves commitment and provides a more efficient long term learning process.

- User can be eventually taught to implement the exhalation through pursed lips into their daily routine and thus change their breathing behavior without raising dependence on technology. Such a behavior can already be observed in humans, for example when a person exhales through pursed lips as a sign of relief.
5.2 Comparison with other game controllers (keyboard, mouse, joystick, touchpad)

Typing on a keyboard/mouse or on screen causes tension in hands and upper back resulting in a tense posture and possibly leading to injuries like "carpal tunnel syndrome". Thus kids start breathing shallow, with upper parts of their lungs which is leading to shortness of breath and low oxygenation. With breathing games kids learn to breathe deeper and slower and also improve speaking skills so they consequently become more assertive, confident and socially active.
## 5.3 SWOT - Strengths, Weaknesses, Opportunities, Threats

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>- video games enhance motivation which leads to greater compliance of breathing exercises</td>
<td>- cannot be used standalone, requires mobile phone or personal computer to work</td>
</tr>
<tr>
<td>- better hygiene due to non-invasive detection of breathing</td>
<td>- kids under 7 years should be assisted by their parents, caregivers or respiratory physiotherapist</td>
</tr>
<tr>
<td>- improves breathing without raising dependence on technology (because user provides pressure by exhaling through pursed lips and not by exhaling into a tube or pipe)</td>
<td></td>
</tr>
<tr>
<td>- higher long term motivation due to weekly new breathing games on Android, iOS, Windows and Mac devices</td>
<td></td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Opportunities</th>
<th>Threats</th>
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<tbody>
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<td>- healthier way to use computers, for example “breathing scrolling” or “breathing television”</td>
<td>- drink water before and after exercise to prevent dehydration</td>
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<td>- improves speaking and singing skills</td>
<td>- short-term dizziness is possible, in that case user should rest between breaths and after exercise</td>
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<td>- “breathing scrolling” may reduce repetitive strain injuries such as carpal tunnel syndrome</td>
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6 EXPERT OPINIONS

6.1 American Lung Association
"Keep using the pursed-lip breathing until the breathless feeling goes away. Rest in between breaths if you feel Dizzy. Give sips of room temperature water."

6.2 Cleveland Clinic
"Pursed lip breathing is one of the simplest ways to control shortness of breath. It provides a quick and easy way to slow your pace of breathing, making each breath more effective."

6.3 University of Iowa Children's Hospital
"Pursed lip breathing helps you use less energy to breathe. It can help you relax. When you are short of breath, it helps you slow the pace of your breathing and can help you feel less short of breath."

6.4 The Ohio State University Medical Center
"Pursed Lip Breathing keeps airways open longer during exhalation. This helps release trapped air from your lungs and allow fresh air to come in. Practise PLB while you are resting so you can use this technique when you are feeling short of breath."

6.5 University of Minnesota Medical Center
"Inhaling through the nose and exhaling through pursed lips makes breathing easier. Pursed-lip breathing can also help you regain control if you’re having trouble catching your breath. You can practice breathing this way anytime, anywhere. If you’re watching TV, practice during the commercials. Try to practice several times a day. Over time, pursed-lip breathing will feel natural."

6.6 University Health Service, University of Michigan
“Pursed-lip breathing helps you breathe more air out so that your next breath can be deeper.”

6.7 Vanderbilt University Medical Center
“Pursed-lip breathing can help you get more oxygen into your lungs when you are short of breath. When you start to feel short of breath, use pursed-lip breathing to control your breathing. Breathing in through the nose and exhaling through pursed or closed lips makes breathing easier.“

6.8 UTMB, The University of Texas
“It is often helpful to have a patient with asthma or COPD exhale through "pursed lips," a maneuver that increases resistance to exhalation at the mouth. This maneuver is believed to transmit an early expiratory back pressure to the bronchial tree and the back pressure is believed to prevent early collapse of small bronchioles and improve exhalation from alveoli (specifically COPD patients).”

6.9 American Thoracic Society
“Pursed-lip breathing attempts to prolong active expiration through half-opened lips, thus helping to prevent airway collapse. Compared with spontaneous breathing, pursed-lip breathing reduces respiratory rate, dyspnea, and PaCO2, while improving tidal volume and oxygen saturation in resting conditions.
7 CONTACT AND MORE INFORMATION

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