Middle/high school students studying microscope incorporated STEM courses.

An add-on lens that turns a smartphone into a microscope.

Incorporated into existing microscope curriculum and existing science kits to increase student engagement time by 100%.

110 interviews (106 F2F, 4 Skype)
PI
Wei-Chuan Shih
Expertise in nanobiophotonics
Associate Professor
Electrical and Computer Engineering
University of Houston

EL
Yulung Sung
Expertise in microfluidic chips
PhD student
Electrical and Computer Engineering
University of Houston

IM
Ken Jones
Expertise in starting companies
Director
Wolff Center for Entrepreneurship
University of Houston
Everybody wants one
I will change the world
<table>
<thead>
<tr>
<th>Key Partners</th>
<th>Key Activities</th>
<th>Value Propositions</th>
<th>Customer Relationships</th>
<th>Customer Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic alliance with school districts to provide microscope lenses for students/teachers to facilitate in STEM education. Strategic alliances with elderly care facilities to provide magnifiers for elderly. Joint-ventures with traditional microscopes and optical component sellers and resellers. Joint-ventures with accessories providers.</td>
<td>Lens manufacture R&amp;D Marketing and sales efforts Understanding feedback</td>
<td>Need for high-quality, low-cost, portable, microscope setup for observation, analysis, and data sharing. Combine a microscope lens with a smartphone. Features: High-quality, low-cost, portable, convenient, easy-to-use.</td>
<td>Ensure customer satisfaction, timely response of questions, set up an online moderated community of users.</td>
<td>B2C, reach out through traditional marketing methods Students, teachers, researchers, field laboratories. Doctors, nurses, engineers. B2B, reach out through directed meeting Medical facilities Jewelry shops IC fabrication checking companies.</td>
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<tr>
<td>Key Resources</td>
<td></td>
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<tr>
<td>Employees (R&amp;D, Marketing, Sales) Production hardware Manufacturing control system</td>
<td></td>
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<tr>
<td></td>
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<tr>
<td>Cost Structure</td>
<td>Revenue Streams</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value driven, economy of scale</td>
<td>Direct sales, subscription sales, resellers, and distributors</td>
<td></td>
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<tr>
<td>Costs: Employees, production and packaging hardware/software, marketing and sales (conferences, booths, print ads)</td>
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</tr>
</tbody>
</table>
Jewelers
Stamp & Coin Collectors
Ophthalmologists
Dentists
Oncologists
Dermatologists
Nurses
Researchers
IC manufacturers
Hobbyist
Wildlife biologists
Laboratories
High school students
Undergraduates
Middle school students
Kids
VAGUE
Quit selling!

We will sell to students via the teachers.

Everyone loved it!

Hypothesis
We have something everyone wants!
Quit selling!

We will sell to students via the teachers.

Everyone loved it!

Hypothesis

We have something everyone wants!
Concerned with the price/features

Hypothesis
- Less expensive
- Better quality
- Fewer training hours required
Concerned with the price/features

“At this price, everyone can have their own microscope”

Gregory Holley
Head of Biology
Pioneer High School

Hypothesis
Less expensive
Better quality
Fewer training hours required

TEACHERS
Forensics
Biology
Env Sci
Phys/Chem

STUDENTS
Concerned with the price/features

“At this price, everyone can have their own microscope”

Gregory Holley
Head of Biology
Pioneer High School

Hypothesis
Less expensive
Better quality
Fewer training hours required

“More fun than a traditional microscope”

Allison Chang
Year 12, AP biology student
Clements High School
Concerned with the price/features

“At this price, everyone can have their own microscope”

Gregory Holley
Head of Biology
Pioneer High School

“High quality and easy to use”
“If only it came with a light”

Donald Winsor
Head of Biology
Dulles High School

Hypothesis
Less expensive
Better quality
Fewer training hours required

“More fun than a traditional microscope”

Allison Chang
Year 12, AP biology student
Clements High School

TEACHERS
Forensics
Biology
Env Sci
Phys/Chem

STUDENTS

Week 1
Concerned with the price/features

“At this price, everyone can have their own microscope”

Gregory Holley
Head of Biology
Pioneer High School

“High quality and easy to use”
“If only it came with a light”

Donald Winsor
Head of Biology
Dulles High School

Getting “YES” all the time led us to a dead end.
Only gave us a set of “desired features”

Hypothesis
Less expensive
Better quality
 Fewer training hours required

“More fun than a traditional microscope”

Allison Chang
Year 12, AP biology student
Clements High School
Who will pay for it?

**Hypothesis**
Teachers will drive the purchase
Who will pay for it?

“Too many competing items for attention and budget”
“Ask parents to buy it”

Hypothesis
Teachers will drive the purchase

William Armstrong
Head of Env. Sciences
Clements High School
Who will pay for it?

“Too many competing items for attention and budget”
“Ask parents to buy it”

Hypothesis
Teachers will drive the purchase

Parents spend $600/year on educational related supplies.
“Too many options”

TEACHERS

PARENTS

STUDENTS

William Armstrong
Head of Env. Sciences
Clements High School
Who will pay for it?

Hypothesis
School will drive the purchase
Who will pay for it?

“Money already spent on microscopes.”
“Microscope purchase not part of operating budget.”

Judy Matney
Head of Sci Dept
Dulles High School

Hypothesis
School will drive the purchase
Who will pay for it?

“Money already spent on microscopes.”
“Microscope purchase not part of operating budget.”

Hypothesis
School will drive the purchase

PRINCIPAL
DEPT HEAD
TEACHERS
STUDENTS

Judy Matney
Head of Sci Dept
Dulles High School

Ronnie Howards
Head of Sci Dept
Dulles High School

“Science department already gets the most money.”
Who will pay for it?

“High tech equipment can be used to apply for next generation science curriculum.”

Hypothesis
Grant money will drive the purchase
Who will pay for it?

“Money not worth the time and effort.”

Jeffrey Morgan
Provost of Education
TeachHOUSTON

“High tech equipment can be used to apply for next generation science curriculum.”

Amber Khan
Biology teacher
Energy Institute

Hypothesis
Grant money will drive the purchase
### Business Model Canvas (High School)

#### Key Partners
- Joint venture in curriculum development with teachers, teaching community, and STEM promotion platforms such as Project Lead The Way.
- Website moderator for curriculum sharing
- App developers for ecosystem development

#### Key Activities
- Lens manufacture, R&D
- Marketing, sales, Feedback

#### Value Proposition
- **Cost-friendly** ($10/student/year compare with $100 for traditional microscopes).
- The most **portable** option, and easiest to use.
- Students enter college **knowing** the basics of microscope use.
- Allows **lower grade** levels to fully immerse in scientific experimentation.

#### Customer Relationships
- Online
- Ensure customer satisfaction through timely response of Q&A, updated FAQ, set up online moderated sharing community of teachers.

#### Customer Segments
- Science students (users)
- Science teachers (buyers)
- Parents (payers)
- Dept head, Principal, Board, ISD (payers)
- Grant approval agencies (payers)

#### Customer Solutions
- Retailers
- Education equipment vendors
- Textbook publishers
- Apps

#### Channels
- Retailers
- Education equipment vendors
- Textbook publishers
- Apps

#### Key Resources
- Employees
- Manufacturing system
- App platform
- Web platform

#### Key Partners
- Employees, production and packaging hardware/software, marketing and sales conferences, booths, print ads

#### Revenue Streams
- Sales (direct, subscription, resale, distributors)

#### Cost Structure
- Employees, production and packaging hardware/software, marketing and sales conferences, booths, print ads

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Good to have

---

WEEK 3
It’s Pivot Time

Hypothesis
Need to incorporate into existing curriculum.
It’s Pivot Time

Mariam Manuel
Director
Katy ISD Curr Dev Center

Having new curriculum improves teaching quality and student engagement

Hypothesis
Need to incorporate into existing curriculum.
Having new curriculum improves teaching quality and student engagement.

Hypothesis
Need to incorporate into existing curriculum.
Hypothesis
Can be incorporated into existing science kits with minimal modifications, to increase kit value.
Easily incorporated into existing curriculum with only slight modifications to improve student engagement.

Hypothesis
Can be incorporated into existing science kits with minimal modifications, to increase kit value.
It’s Pivot Time

Easily incorporated into existing curriculum with only slight modifications to improve student engagement.

Hypothesis
Can be incorporated into existing science kits with minimal modifications, to increase kit value.
It’s Pivot Time

Easily incorporated into existing curriculum with only slight modifications to improve student engagement.

Bundled with textbook to increase value.

Hypothesis
Can be incorporated into existing science kits with minimal modifications, to increase kit value.
Hypothesis
Incorporate into distributor science kits with minimal kit modifications.
**Epiphany**

Liam Casey  
Head of Marketing in Biology  
Ward’s Science (VWR)

Combine with current kits to create kit of greater interactivity and value.

Use existing distribution channels.

**Hypothesis**
Incorporate into distributor science kits with minimal kit modifications.
Hypothesis
Incorporate into distributor science kits with minimal kit modifications.

Combine with current kits to create kit of greater interactivity and value.

Use existing distribution channels.
Fits into current curriculum and kits on microscopes without extensive modification.

Provides ecosystem to enhance proper use of technology in high school classes.

Increased student interactivity with improved quality, decreased cost.

Students enter college knowing the basics of microscope use.

Allows lower grade levels to fully immerse in scientific experimentation.

Cost-friendly ($10/student/year compare with $100 for traditional microscopes).
Our decision

App development

Sales Cycle

Volume

Pricing
When will you need these resources

2014 May: Discovered process
2014 Nov: Failed crowdfunding
2015 May: Considered startup
2015 Oct: I-Corps

2016 Jan: Start ramping up production to projected sales volume.
2016 Apr: Check to see if we are on track.
Cash flow breakeven

$100K monthly sales

Start
I-CORPS
2 years
<table>
<thead>
<tr>
<th>Category</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distributor</td>
<td>$500,000</td>
</tr>
<tr>
<td><strong>Selling Costs (for 100,000 lenses)</strong></td>
<td>$500,000</td>
</tr>
<tr>
<td>Taxes</td>
<td></td>
</tr>
<tr>
<td>Profit</td>
<td></td>
</tr>
<tr>
<td>Packaging and Shipping ($2 per packaging, $2 per shipment)</td>
<td></td>
</tr>
<tr>
<td>Office space, office equipment</td>
<td>$1,000</td>
</tr>
<tr>
<td>Equipment</td>
<td>$1,000</td>
</tr>
<tr>
<td>$10,000/month RD</td>
<td></td>
</tr>
<tr>
<td>$2,000/month packaging</td>
<td></td>
</tr>
<tr>
<td>100,000 lenses cost $1,000</td>
<td></td>
</tr>
</tbody>
</table>

$14,030 for 1K lenses
$33,200 for 10K lenses
$215,000 for 100K lenses
Key financials metrics for costs in your business model?

- Cost for raw material
- Cost for disposable supplies and equipment
- Cost for packaging
Costs vs. ramp vs. product iteration?

Fixed monthly cost $20K for human resources, equipment, and other resources.

Ramping production cost $1 per lens created, may need extra inventory space if exceeds 50K lenses created.

Product iteration, R&D requires $20K for human resources, equipment, and other resources.
Resource assumption spreadsheet

People
$200K in the first year, including product manufacture, design, packaging, fulfillment, etc...

Hardware
$100K for high volume throughput manufacturing system and office/inventory space.

Software
$10K for fulfillment system.

Prototypes
$100K for continuing RD, expanding product line.

Legal
$20K in the first year for legal paperwork, startup company, apply for sales/resales tax forms, import/export forms.
Older slides
What type of business are you building

Startup

We provide

*Hardware (lens)*

*Software (educational, course-specific apps, general object identification apps) through partnered app developers.*

*Ecosystem (curriculum development sharing and support website for teachers and instructors) through partners in website moderators and developers*
Petal Diagram - Competitive

Adjacent Solutions/Markets
- THOR LABS
- GO Edmund optics worldwide
- Canon
- SONY

Technological Substitutes
- Magnifiers

Technological Alternatives
- DSLR cameras
- Electron microscopes
- Custom optical tables

Current Solution
- Microscopes + camera
- Competitor solution
- DIY kit

DOTLENS
Channel diagram

- Lens
  - Online
  - School retailer
  - Retailers (Walmart, Amazon, ...)
  - Inventory
  - School equipment vendor
  - Buyer (Teacher / Parent)
Distribution complexity

- Online sales
- Online retailers
- Retailer
- School retailers

Direct sales (lens) to professional services
Direct sales (system) to professional services (medical)

Solution complexity
Marketing complexity

Higher volume
Higher value added
Customer Discovery

Get

- Journal publications
- Conference presentations
- Magazine articles
- Trade shows
- TV/Web advertisements
- Website

Keep

- Excellent customer service
- Excellent support
- Periodically updated Website/FAQ

Grow

- Version 2+ product
- Loyalty program
- Reseller discounts
- Cross-market licensing
### Demand creation budget and forecast

<table>
<thead>
<tr>
<th>Area</th>
<th>Sub-Area</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Study</td>
<td>NSF I-Corps</td>
<td>Cost: $50,000 / 6 weeks</td>
</tr>
<tr>
<td>Publications</td>
<td>Updated website and apps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Seasonal publications on peer-review journals</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Seasonal presentation in professional conferences</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bi-monthly magazine articles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cost: $100,000 / year</td>
<td></td>
</tr>
<tr>
<td>Trade Shows</td>
<td>Annual education trade shows in different locations.</td>
<td>Cost: $60,000 / year</td>
</tr>
<tr>
<td>Advertisement</td>
<td>TV ads ($10,000)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Print ads ($10,000)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Web clicks ($20,000)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social network clicks ($20,000)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cost: $60,000 / year</td>
<td></td>
</tr>
<tr>
<td>IP Management</td>
<td>Patents</td>
<td>Cost: $20,000 / year</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>$300,000 in the first year</td>
</tr>
</tbody>
</table>
## Customer acquisition cost

<table>
<thead>
<tr>
<th>Publications</th>
<th>Trade Shows</th>
<th>Advertisement</th>
</tr>
</thead>
</table>
| 4 journal articles with 5,000 shares generating 500 customers | Trade show attracts 5,000 with 1,000 visits, and 500 customers | TV ads ($10,000)  
Print ads ($10,000)  
0.1% activation generates 1,000 customers |
| 4 conference presentations with 1,000 attendees generating 100 customers | 12 shows a year | Web clicks and social network clicks at $0.50 per click with 10% activation rate generates 8,000 customers |
| 6 monthly magazine articles with 100,000 readers generating 1,000 customers | | |
| Cost: $100,000 for 1,600 customers  
= $62.5 / customer | Cost: $60,000 for 6,000 customers  
= $10 / customer | Cost: $60,000 for 9,000 customers  
= $7 / customer |

$300,000 for the first 20,000 customers  
$15 per customer acquisition
Customer lifetime value

**Lifetime Value**

- Average profit
- Customer lifetime
- Acquisition cost

$9 profit per lens
x 3 lenses per sale
x 2 lenses per year
- $15 acquisition

$30 value
Channel Economics

**Cost of Goods**
Lens material, fabrication system, packaging, labor

$1.50 / lens

**Profit, SG&A, RD**
+$5  profit
+$1  SG&A
+$2.5  RD

**Retailer**
Direct school, online, traditional take 30% markup
+$5

**Discounts**
Academic discounts
Volume discounts
Payment flow

Raw materials / Systems provider

Packaging and design

Shipping and inventory

Web/app developer

DotLens

Lens

Website/app (considering $0)

Teacher

Dept head

Principal

Board budget approver

School board

Parents
Revenue model strategy

Licensing deal (Univ of Houston)
- $0 Upfront payment
- 10% Company ownership
- 3% Royalty on sales

OR

Personal funding
- $100,000 Upfront payment
- 0% Company ownership
- 0% Royalty on sales

2014-2015
Discovery
- Preliminary research
- Publication
- Patent

2015
Market analysis
- Mass production testing
- Quality control
  - Packaging
  - Pricing

+ Sales

2016+
Further development
- Interactive website/app
- Product version 2.0
- Further marketing strategies

Own funds
- I-Corps
- SBIR

Own funds