Let’s Talk It Out: A Chatbot for Effective Study Habit Behavioral Change

Xiaoyi Tian*, Zak Risha, Ishrat Ahmed,
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CSCW 2021
Introduction

First-year college experience can be very challenging

• Transition to new environment
• Inadequate study habits and skills (Chamundeswari, 2014)
• High attrition rates, particularly in Computer Science (CS)

Remote learning environments under COVID-19

• More supports are needed
Chatbots as persuasive technology may help

• Aim to change everyday behavior
  • Journaling food (Lukof et al, 2017)
  • Self-reflection at work (Williams et al, 2018)

• Our goal: Design a chatbot for study behavioral change
Outline

• Design inquiry

• *StudyBuddy* features and prototypes

• Evaluation and design recommendation

• Conclusion
Outline

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Design Inquiry

Peer-tutor interview
3 CS peer tutors

In-class Survey
83 students
(94% freshman)
Design Inquiry Findings

• Common challenges first-year students are facing
  - Time management
  - Task management
  - Lack of domain knowledge
  - Unfamiliar with academic resources

• Expressed interest in using chatbot for study behaviors
• Perceived useful of chatbot features
Outline

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Design Flowchart
StudyBuddy Features

- Insider tips
- Reminders
- connecting to a tutor
- Study habit feedback
- Task breaking-down
- recommending academic resources
StudyBuddy Prototypes

- Insider tips
- Reminders
- Study habit feedback
- Task breaking-down

Slack App
StudyBuddy Prototypes

Insider tips

Study habit feedback

Task breaking-down

Slack App

: If you’re stuck with something, try visualizing, pen and paper! *(functional tip)*
StudyBuddy Prototypes

Insider tips

Study habit feedback

Task breaking-down

Slack App

- If you’re stuck with something, try visualizing, pen and paper! *(functional tip)*

- It’s okay to take a break. *(motivational tip)*
StudyBuddy Prototypes: Storyboards

- StudyBuddy helps with study habits
- Feedback recommending academic resources
- Connecting to a tutor

Example storyboards:
- Helen receives a reminder from StudyBuddy.
- Helen connects to a peer tutor.
- Helen plans her course and writes her assignments.
- Helen codes her assignment and receives feedback.
- Helen checks her work and receives reminders.

StudyBuddy helps with study habits, feedback, and connecting to tutors.
Outline

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Evaluation

Student Interview
8 students
first-year and senior students

Usability Survey
117 students
All year groups of undergrads

Instructor Interview
5 CS course instructors
Design recommendations

• Building Trust with Users
• Personalizing the Chatbot Experience
• Gender and Individual Differences
• Immediate Help vs. Long-term Sustainable Support
• Design for a Context-Aware Chatbot
Design recommendations

• Building Trust with Users
• Personalizing the Chatbot Experience
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• Immediate Help vs. Long-term Sustainable Support
• Design for a Context-Aware Chatbot
**Student interview findings**

- Variations of perception of different tips among individuals

<table>
<thead>
<tr>
<th>Overall ranking</th>
<th>Category</th>
<th>Tip content</th>
<th>Ranking by each participant (The darker indicates higher rank)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Functional</td>
<td>If you're stuck with something, try visualizing, pen and paper!</td>
<td>f1: 1 1 6 3 2 1 3 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Before you write the program, try to visualize the entire idea in your mind, come up with the main cases, write the algorithm, have a pseudo code. Then, your programming will be faster and have less bugs.</td>
<td>f2: 2 3 1 2 3 2 6 2</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Always write code in incrementally functional bits.</td>
<td>f3: 5 2 3 4 9 6 4 6</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>It is always a good idea to write functions in your program</td>
<td>f4: 6 7 5 5 6 4 5 5</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>To debug a program you can place print statements (a quick and dirty way).</td>
<td>s1: 8 6 7 1 7 3 8 4</td>
</tr>
<tr>
<td>9</td>
<td>Motivational</td>
<td>The debugger is your friend.</td>
<td>s2: 7 5 8 7 8 9 7 3</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Algorithms is what makes us separate from others, try to be good at them!</td>
<td>s3: 9 8 9 6 10 8 9 7</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>If you're studying late in the night, make sure to get some sleep before the test.</td>
<td>s4: 4 4 10 8 1 5 1 9</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>....it's okay to take a break.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>When the going gets tough, the tough gets going!</td>
<td></td>
</tr>
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<td>11</td>
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<td>Coffee is your second friend.</td>
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<td>f1 1 f2 1 f3 3 f4 2 s1 1 s2 3 s3 1 s4 1</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Before you write the program, try to visualize the entire idea in your mind, come up with the code. Write the algorithm in pseudo code. Then, your program will be more clear.</td>
<td>f1 4 f2 2 f3 4 f4 3 s1 3 s2 6 s3 2 s4 2</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Always write good code since you won’t have to rewrite it in the future.</td>
<td>f1 6 f2 2 f3 4 f4 5 s1 6 s2 4 s3 5 s4 5</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>It is generally a good idea to implement the code you have (or debug the program (not a dirty way)).</td>
<td>f1 8 f2 6 f3 4 f4 7 s1 8 s2 8 s3 8 s4 7</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>The debugger is your friend.</td>
<td>f1 5 f2 8 f3 4 f4 9 s1 8 s2 9 s3 7 s4 8</td>
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<td>f1 10 f2 10 f3 8 f4 1 s1 5 s2 1 s3 7 s4 1</td>
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<td></td>
<td>…it’s okay to take a break.</td>
<td>f1 10 f2 2 f3 4 f4 7 s1 2 s2 4 s3 7 s4 8</td>
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<td></td>
<td>When the going gets tough, the tough gets going!</td>
<td>f1 3 f2 9 f3 4 f4 10 s1 5 s2 10 s3 10 s4 2</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Coffee is your second friend.</td>
<td>f1 11 f2 11 f3 11 f4 11 s1 11 s2 11 s3 11 s4 11</td>
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In CS, you can ONLY achieve motivation if you succeed in a project. - Senior student 2
# Student interview findings

- Variations of perception of different tips among individuals

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<td>If you’re stuck with something, try visualizing, pen and paper!</td>
<td>f1: 3, f2: 3, f3: 2, f4: 1, s1: 3, s2: 1, s3: 1, s4: 1</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Before you write the program, try to visualize the entire idea in your mind,</td>
<td>f1: 3, f2: 3, f3: 2, f4: 1, s1: 3, s2: 1, s3: 1, s4: 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>come up with the worst cases, write the algorithm in pseudo code, then, your</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>program.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Always write code in comments for readability.</td>
<td>f1: 6, f2: 3, f3: 4, f4: 9, s1: 6, s2: 4, s3: 6, s4: 6</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>If it’s always a good idea to implement the for loop with a for loop</td>
<td>f1: 6, f2: 3, f3: 4, f4: 9, s1: 6, s2: 4, s3: 6, s4: 6</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>To debug a program you can place the debugger in a variable (a dirty way).</td>
<td>f1: 8, f2: 6, f3: 7, f4: 3, s1: 7, s2: 3, s3: 8, s4: 4</td>
</tr>
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<td>10</td>
<td></td>
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<td></td>
<td>Algorithms is what makes us separate from others, try to be good at them.</td>
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<td>If you’re studying late in the night, make sure to get some sleep before the</td>
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</tr>
<tr>
<td>7</td>
<td></td>
<td>test. It’s okay to take a break.</td>
<td>f1: 8, f2: 6, f3: 7, f4: 3, s1: 7, s2: 3, s4: 8</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>Coffee is your second friend.</td>
<td>f1: 8, f2: 6, f3: 7, f4: 3, s1: 7, s2: 3, s4: 8</td>
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</table>

- **Senior student 2**

In CS, you can ONLY achieve motivation if you succeed in a project.

- **Senior student 4**

I will feel closer to the bot if it has a fun personality.
### Variations among individuals

**Design Lesson Learned 1:**

**Personalizing the chatbot experience**

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<td>If you're stuck with something, try visualizing, pen and paper! Before you give up on a problem, try to imagine how it could be solved.</td>
</tr>
<tr>
<td>2</td>
<td>Functional</td>
<td>It is a known fact that the debugger is your personal best friend. To debug a program, you first need to understand the code.</td>
</tr>
<tr>
<td>3</td>
<td>Functional</td>
<td>The debugger is your best friend. To debug a program, you first need to understand the code.</td>
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<td>If you're studying late at night, make sure to get some sleep before the test. It's okay to take a break.</td>
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<td>Motivational</td>
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<table>
<thead>
<tr>
<th>f1</th>
<th>f2</th>
<th>f3</th>
<th>f4</th>
<th>s1</th>
<th>s2</th>
<th>s3</th>
<th>s4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td></td>
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<tr>
<td>3</td>
<td>9</td>
<td>9</td>
<td>6</td>
<td>10</td>
<td>8</td>
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<td>7</td>
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<td>10</td>
</tr>
</tbody>
</table>
• Unified Theory of Acceptance and Use of Technology (UTAUT)

Student usability survey

Self Management of Learning  Trust
Effort Expectancy  Performance Expectancy
Satisfaction  Behavioral Intention

High Behavioral Intention
Student usability survey

- Unified Theory of Acceptance and Use of Technology (UTAUT)

- Female higher than male
Student usability survey

Design lesson learned 2

Gender and individual differences
Student usability survey

- Student ranking of designed features
Whenever I receive a project, it feels like an overwhelming amount of work.

- Anonymous female senior student
Feature Perception: instructors vs. students

Managing projects themselves is an important aspect to prepare for industry.
- Instructor 5

Whenever I receive a project, it feels like an overwhelming amount of work.
- Anonymous female senior student
Feature Perception: instructors vs. students

Graduated students are the best resource for navigating college, but are hard to get a hold of.

- Anonymous female first-year student
Feature Perception: instructors vs. students

Graduated students are the best resource for navigating college, but are hard to get a hold of.
- Anonymous female first-year student

It could be used in a negative way. Teachers don’t change course content, it’s easy to cheat.
- Instructor 1
Feature Perception: instructors vs. students

I don’t care what a bot thinks about my life.

- Anonymous male first-year student
Feature Perception: instructors vs. students

I prefer Google.
- Anonymous male senior student
Feature Perception: instructors vs. students

I prefer Google.
- Anonymous male senior student

What I teach is different than what the internet provides.
- Instructor 5
Feature Perception: instructors vs. students

I prefer Google.
- Anonymous male senior student

What I teach is different than what the internet provides.
- Instructor 5

Design Lesson Learned 3

Immediate help vs. Long-term sustainable support
Future work

• Long-term adaptation
• Early detection of students in higher risks
• Department decision-making
  • Curriculum formation
  • Teaching resource allocation
• Support distance education
Key Takeaways

• Our prototype of a chatbot to improve study habits was perceived useful by students, though was influenced by factors like gender and individual experiences.

• In designing a chatbot for behavioral change, we need to personalize the experience based on the user and context.

• To ensure continued use, a chatbot should balance between offering immediate help and long-term sustainable support.
Thanks

Authors

- Xiaoyi Tian
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- Ishrat Ahmed
- Arun Balajiee
- Lekshmi Narayanan
- Jacob Biehl

Acknowledgements

- All student and instructor participants at Pitt
- Matt Burton (CS department at Pitt)
- Joseph Wiggins (LearnDialogue group at UF)

Contact

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