Establishing Best Practices for Mentorships Between Boeing Coaches and College Students Participating in AerosPACE

GLOBAL PRODUCT DATA
INTEROPERABILITY
SUMMIT 2014

ELYSIUM Parker NORTHROP GRUMMAN BOEING

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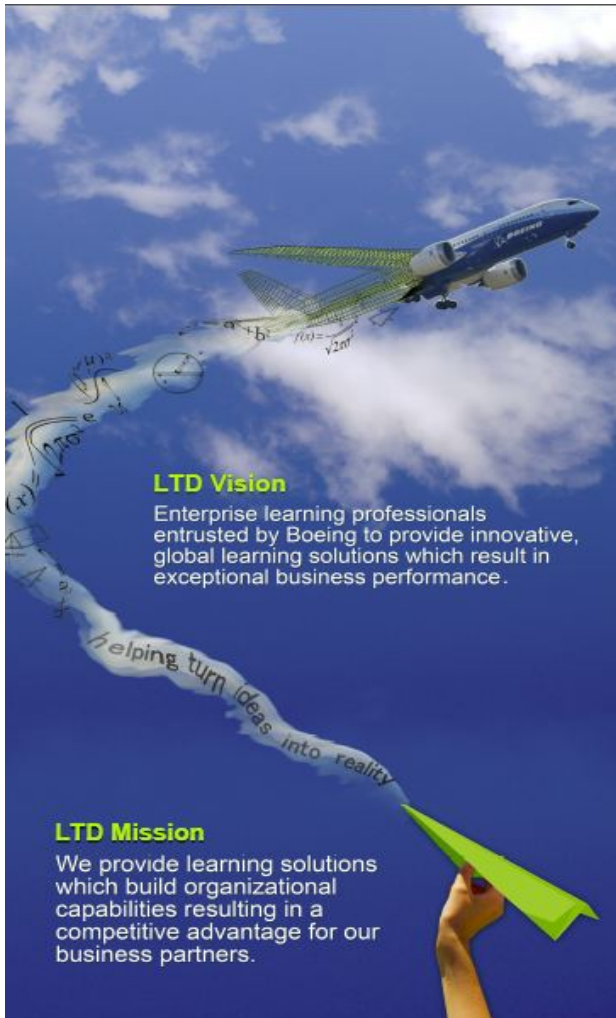
Agenda

- **Background**
- **Study Focus**
- **Actions**
- **Results**
- **Summary**
- **Next Steps**

Background

LTD Vision
Enterprise learning professionals entrusted by Boeing to provide innovative, global learning solutions which result in exceptional business performance.

LTD Mission
We provide learning solutions which build organizational capabilities resulting in a competitive advantage for our business partners.

Learning
Training
Development

Engineering Training

Learning, Training, and Development (LTD) is your Boeing Engineering workforce resource for knowledge and skills training.

State-of-the-art learning solutions and resources
- CATIA
- ENOVIA
- PDM
- NX
- Safety
- Teamcenter
- Stress analysis
- Certificate programs
- And more

Workplace coaching
- Peer-to-peer mentoring
- One-to-one coaching
- One-to-many coaching
- Job aids
- Seminars

Customized learning solutions development
- Workplace performance needs analysis
- Design and development
- Delivery
- Evaluation

LTD Engineering
Together, we're the future of Boeing. Come learn with us!
EngineeringLearningSolutions.web.boeing.com

Background

LTD Education Programs

- Build education programs for Boeing engineers
- Partner with universities
- Develop learning investment strategies
- Apply learning sciences & technology innovation to engineering design strategies

Background

"Beyond financial support, we've taken broad steps with educators, government, industry and others to help __*create a pipeline of technically educated and skilled workers*__ *suited for the jobs and challenges of a global economy."*

One link in this pipeline . . .

AerosPACE
(Aerospace Partners for the Advancement of Collaborative Engineering)

John Tracy
Chief Technology Officer
SVP - Engineering,
Operations & Technology
The Boeing Company

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Background

AerosPACE = Industry & Academia Collaboration

Workforce Needs

Institutional Access to Students

Knowledge of Critical Skills

Focus on Education

Product Development Cycle

Foundational Research

Customer Focus

Educational Accreditation

Lifecycle Approach

Background

Learning Science

Distributive Stakeholders

Engineering Education Research

- STEM Pipeline
- Distributed Learning
- Teamwork
- Mentor/Mentee Relationships

Educational Improvements
"Learning to Learn"

Industry-Academia Collaboration
"Knowing what to learn"

Stakeholders

- The Boeing Company
- Universities
  - Brigham Young University
  - Georgia Institute of Technology
  - Purdue University
  - Embry-Riddle, Prescott AZ
- Partners
  - CD-Adapco
  - Stratasys
  - NASA

AerosPACE

Novel Manufacturing Processes
"Learning by Doing"

Novel Collaborative Tools
"Learning to work together"

Advanced Manufacturing

- Additive Manufacturing
- Distributed Manufacturing
- Hands-on experience

Advanced Manufacturing

Social Networking

Collaboration

- NX Connect
- CorpU
- Multidisciplinary Students
- Crowdsourcing

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Background

Unique feature of the AerosPACE project:

Students given access to industry SME's: Boeing LTD Engineering Performance Coaches

- **Help with Product Lifecycle Management (PLM) applications and processes:**

    – Once knowledge and skills are acquired (post-training), workplace coaches are available to help supplement the training and accelerate learning comprehension

Background

At Boeing, coaches provide common learning solutions:

- Engineering Support Line: Virtual On-Demand Coaching Support
- 1 on 1 Mentoring: On-Demand Personal Coaching
- Group Consulting: Group Consultations, Presentations, Demos
- Learning Snacks: Short Video Animations, Simulations
- Seminars: Methodology / Process Specific Presentations
- Job Aids: Step-by-Step Outline of Tool Functionality
- Workshops: Hands-on Functional Training

Background

For AeroPACE, coaches provide overarching, consistent communication and support:

Technical

- Assist students across the design-build-fly phases:
    - Design Tools (CAD/CAM, FEA, and CFD)
    - Modeling techniques for lofting and surfacing, parametric design, etc.
    - Project Management
- Share feedback from design reviews with student teams
- Lecturers (PLM, FEA, and Teamwork)
- Consult with Boeing peers

Interactions

- Day-to-day business exchanges (calls and emails)
- Bi-weekly meetings with team leads (WebEx)
- Team and project dialogs via LMS
- Information exchanges with students

Study Focus

AerosPACE students and Boeing coaches helped push the collaborative interaction aspects of the project:

- **Students appreciated working with the Boeing Coaches:**

    - Tap into aerospace/CAD expertise
    - Rich technical exchanges to solve problems
    - Importance of Project Management
    - Design review feedback
    - Presentation skills
    - Business perspectives

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Study Focus

- **Boeing coaches enjoyed interacting with the student teams:**

    - Able to share expertise
    - Fun to help teams overcome challenges
    - Helped grow as a Boeing employee
    - Influence innovation – help the future of Boeing

Study Focus

Sample email exchange between **Student**, Boeing Coach, and Boeing Expert:

STUDENT to COACH:

Hello! I am running into some problems with the propulsion system. Can you help me out, or do you know anyone who can? Thanks.

    COACH to STUDENT:

    Sure thing. What help do you need?

STUDENT to COACH:

Thanks. My team has picked the motor, prop batteries, etc. Can you help, of do you know anyone at Boeing who could evaluate our choices?

    COACH to STUDENT:

    I'm going to refer you to a propulsion expert. He is AWESOME! Please send me what you want reviewed.

STUDENT to COACH:

The attached screen shot shows the system that we are planning on using. If they want they can email me with any questions or tips they might have. Thank you for the help.

Study Focus

Sample email exchange between Student, Boeing Coach, and Boeing Expert:

BOEING COACH TO BOEING EXPERT
Hey…This slide doesn't mean anything to me. How about you?

BOEING EXPERT to BOEING COACH:
Yeah, this is a screen shot of Motocalc, which is a desktop program that can analyze the performance of a given motor/battery combination—in this case, a Hacker A50 on two parallel 5-cell lipo packs.

BOEING COACH to STUDENT:
Here is some good information.

STUDENT to BOEING COACH:
Hey, thanks!

Study Focus

Sample email exchange between Student, Boeing Coach, and Boeing Expert:

STUDENT TO BOEING EXPERT:

Hello! Our UAV weighs about 12 lbs and has an 8 ft wingspan. It needs to fly for about 1 hour. No hard maneuvers. Here's our system:

- Motor: Hacker A-50-14X SV3 (520 Kv)
- Prop: APC 16x10 Thin Electric Propeller
- Battery: Thunder Power TP6600 6S2P
- ESC: Hacker MasterBasic 70SB

The problem I was running into was getting a light enough system that provided the 1 hour flight time and the necessary power and thrust at takeoff. Are there any potential problems you could see us running into?Also from your experience, is Motocalc pretty reliable on the numbers it gives as far as duration, thrust, etc.? Thanks for being willing to help us. I look forward to hearing from you.

Sample email exchange between Student, Boeing Coach, and Boeing Expert:

BOEING EXPERT to STUDENT:

Hi, good to hear about your project—sounds like it would be a lot of fun.

4.7lbs and 2,000 squares is a lightweight airplane, at only 5.25oz/sqft wing loading (this is glider territory). Looks like you are planning on extracting around 1500 watts from your motor, yes? This assumes a 22.2v battery (6-cell lipo), and about 65-70 amps draw. That puts you at 300 watts/lb, which is an exorbitant power loading, capable of unlimited vertical climb. You have more than enough power for take-off and climb, and you will find that you can cruise along just fine with the throttle barely cracked open. To extract a one-hour duration from your 13.2 Ah capacity, you will need to draw less than 13 amps (accounting for inefficiencies), which will equate to 288 watts. This will provide a power loading of 60 watts/lb, which is more than adequate for straight-and-level cruising (in fact, you can still do mild aerobatics at that power loading).

You will want to experiment with different size and pitch props on Motocalc, and see for yourself the effect of prop choice on motor efficiency. A smaller prop will draw less current, and produce less thrust, which is what you need for duration. Cruising around for one hour on today's electrics is no challenge anymore, where only a decade ago this was considered a monumental feat.

Have fun, and good luck with your trials!

Study Focus

Sample email exchange between Student, Boeing Coach, and Boeing Expert:

STUDENT to BOEING EXPERT and COACH:

Thank you both for the responses. So I may have made it sound like the plane is lighter than it really is. The propulsion system weighs about 4.7lbs, but the whole aircraft weighs about 12 lbs. We have maxed it out as far as weight goes because Boeing would like it to be under 12 lbs. We have an autopilot, two cameras, a pitot tube, a compass, etc. on board. I included some slides from our constraint analysis. They are attached below if you would like to take a look at them. Do you think the system is over powered then? Because from what our performance team said, we needed quite a bit of thrust (9lbs) for the hand launch and also quite a bit to climb.

BOEING EXPERT to STUDENT:

Ah, okay. 12lbs is about 13oz/sqft, which is still not a high wing loading. You will need about 600watts for take-off and climb, and about 400 watts for cruising around. The Hacker A50 makes more sense now.

BOEING COACH TO STUDENT AND STUDENT:

Nice work! Looks like you are good to go.

Study Focus

However, both students and Boeing coaches felt awkward about exploring topics outside the technical domain.

- **Students wanted advice about non-technical topics, internships, employment opportunities, career development, etc. but weren't sure about what/how/when to ask for**

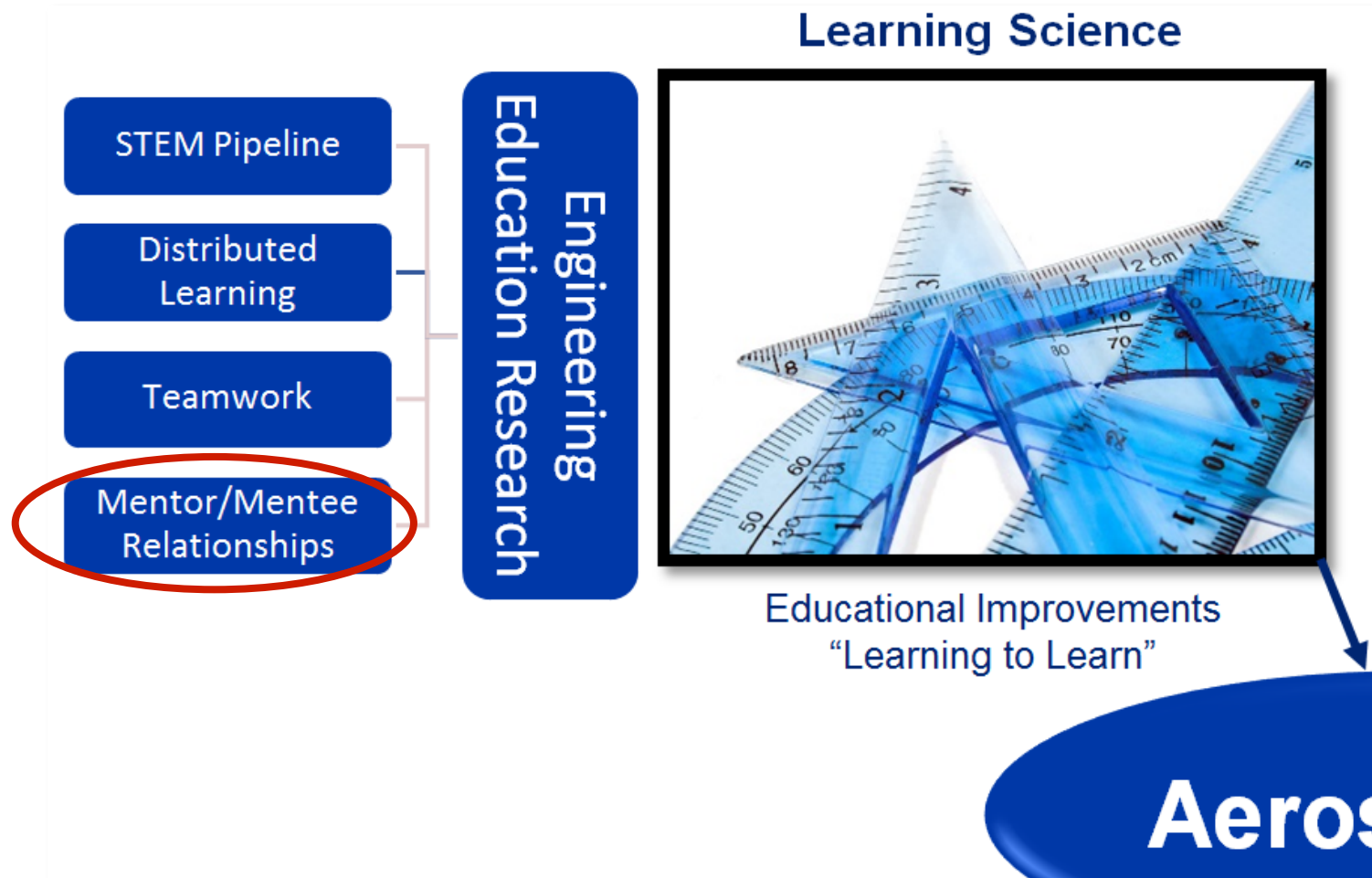- **Coaches weren't sure about what/how/when to give advice**

Study Focus

Learning Science

STEM Pipeline

Distributed Learning

Teamwork

Mentor/Mentee Relationships

Engineering Education Research

Educational Improvements
"Learning to Learn"

Distributive Stakeholders

Stakeholders

The Boeing Company

Universities

Partners

Brigham Young University

Georgia Institute of Technology

Purdue University

Embry-Riddle, Prescott AZ

CD-Adapco

Stratasys

NASA

Industry-Academia Collaboration
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AerosPACE

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Crowdsourcing

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Study Focus

Actions

Led to post 2013-2014 Actions:

1. **Research and evaluate existing mentoring programs to support AerosPACE participants**

2. **Define best practices for Boeing Coaches to mentor college students – Survey**

Actions: Researched Best Practices

1. **Researched and Evaluated Best Practices:**

    A. **Web Search**
    B. **Boeing Mentoring Programs**
    C. **Mentoring Community of Practice (InSite)**

Actions: Researched Best Practices
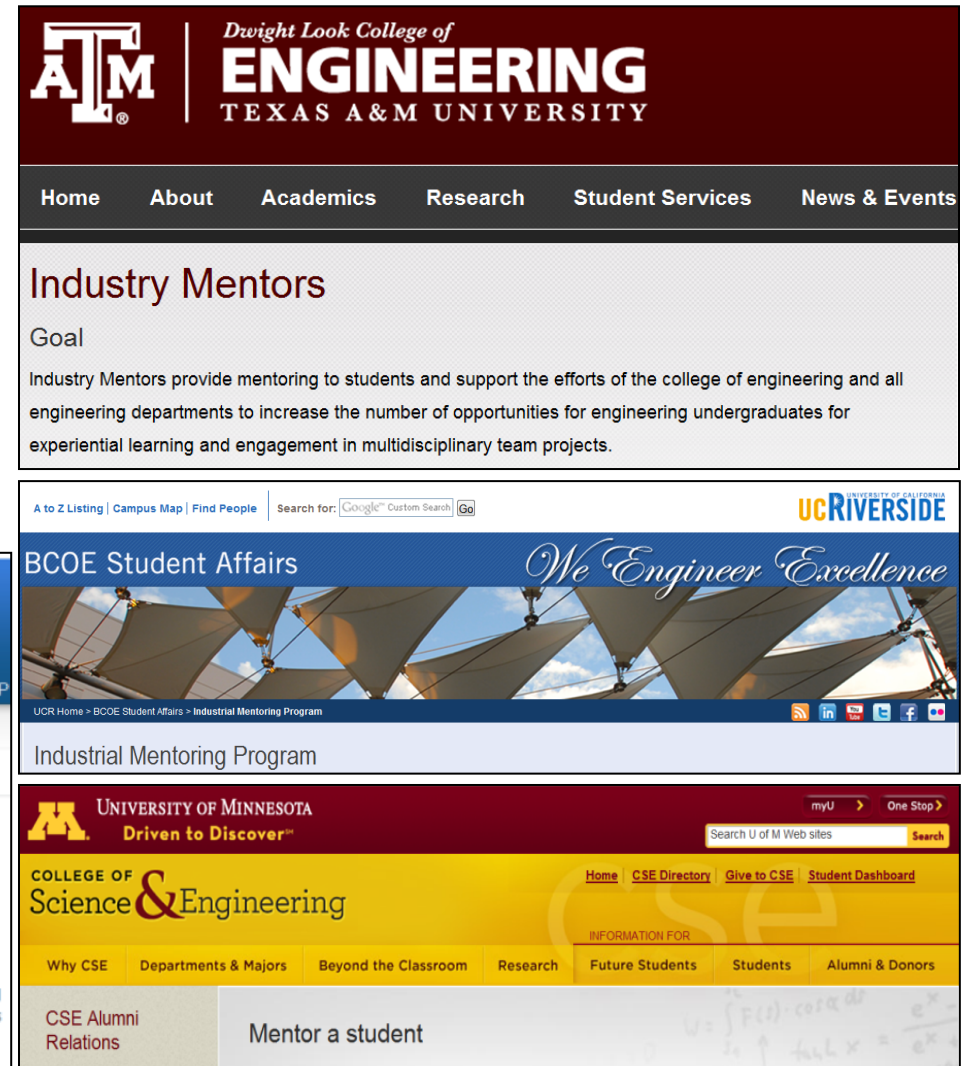
A. Web Search

Many universities & professional societies have academic/industry mentoring programs

Actions: Researched Best Practices

B. Mentoring Programs at Boeing:

- **Career Mentoring** – enhancing a protégé's skills, competencies, and technical knowledge
- **Technical Mentoring Program** – knowledge transfer of critical skills
- **Executive Mentoring** – a relationship with a senior-level manager
- **Experienced Mentoring** – advising on a wide-range of technical and managerial issues
- **Group Mentoring** – one mentor and several protégés, often found in intact work groups
- **Peer-to-Peer Mentoring** – between two individuals of similar level, experience, or job function
- **Reverse Mentoring** – less experienced individual is mentor / experienced individual is the protégé
- **Rotation Mentoring** – assists an employee in adjusting to a new rotation environment

Actions: Researched Best Practices

C. Mentoring Community of Practice (InSite):

- Be available
- Respond/Follow-up immediately
- Be a good listener
- Establish agreements – set clear expectations
- Be professional
- Work with professors
- Respect each others views, experiences, and privacy
- Work hard to make the relationship a two-way street
- Be patient with students
- Keep a "Mentoring Discussion Log"
- Play the devil's advocate to help mentee with problem solving

Actions: Researched Best Practices

Research provided good information and examples.

However . . .

What do new Boeing employees think would be the best practices for Boeing Coaches to use for mentoring college students?

Conducted survey to capture best practices

Actions: Survey

Survey Description:

- **Constructed survey using Boeing Survey Builder**

- **14 questions:**
    - Derived from review of Web Search, Boeing Programs, and InSite responses

- **Distributed to:**
    - **REACH** Program participants:
        - 0-5 year employees
        - Provides professional development, community involvement, and networking opportunities

Results of Mentoring Best Practices Survey

Results in three parts:

1. Study Population
2. Content for Meetings
3. Structure for Meetings

Results of Mentoring Best Practices Survey

Description of Population Sample
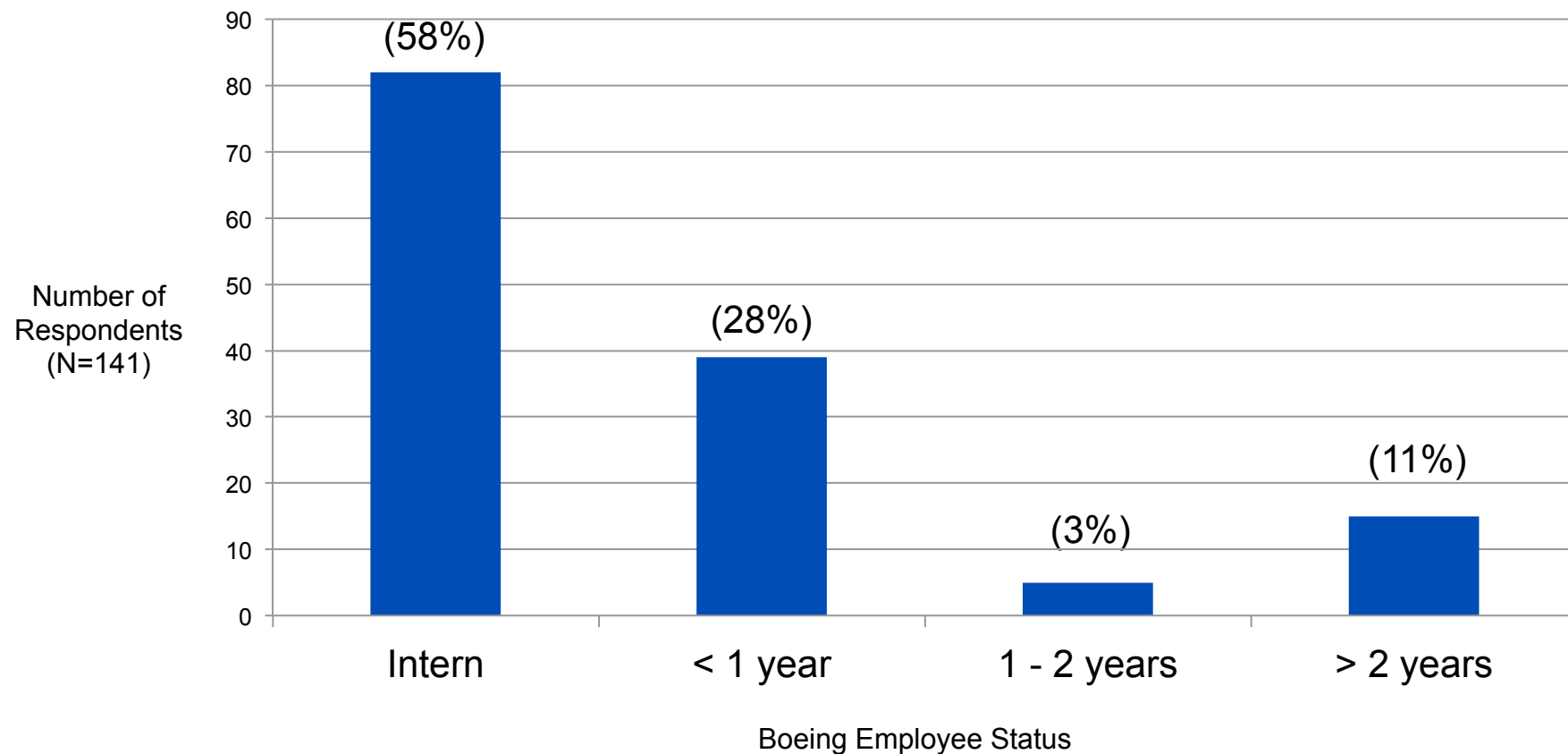
Number of Respondents (N=141)

Boeing Employee Status

Results of Mentoring Best Practices Survey

Most Important Topics (Top 4)
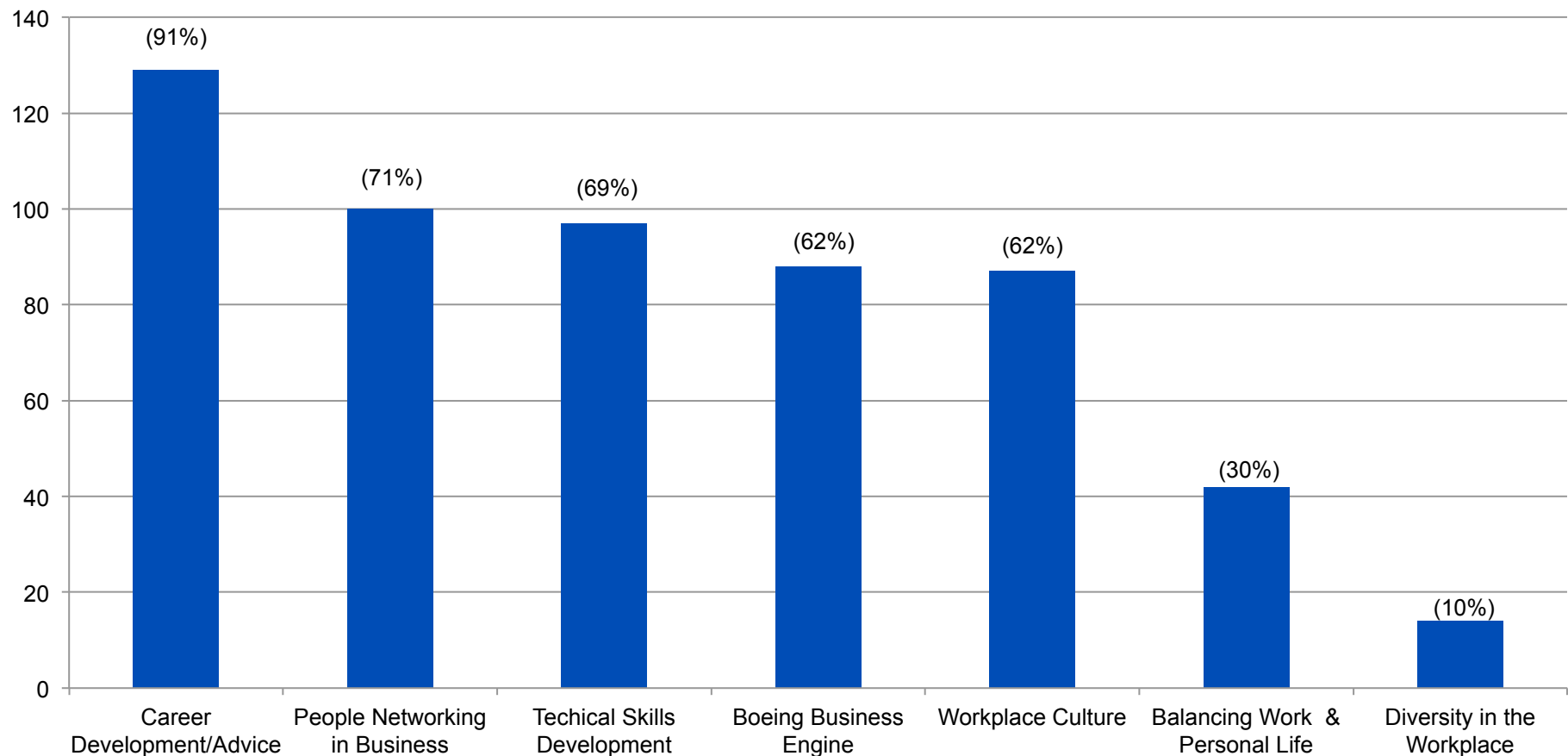
Results of Mentoring Best Practices Survey

Other Topics To Address

Number of Respondents (N=92)

- Opportunities to work with Boeing: (54%)
- Communication Protocols: (34%)
- Transitioning from College to the Workforce: (27%)
- Local Community Information: (13%)
- Financial Planning: (12%)
- Other: (11%)
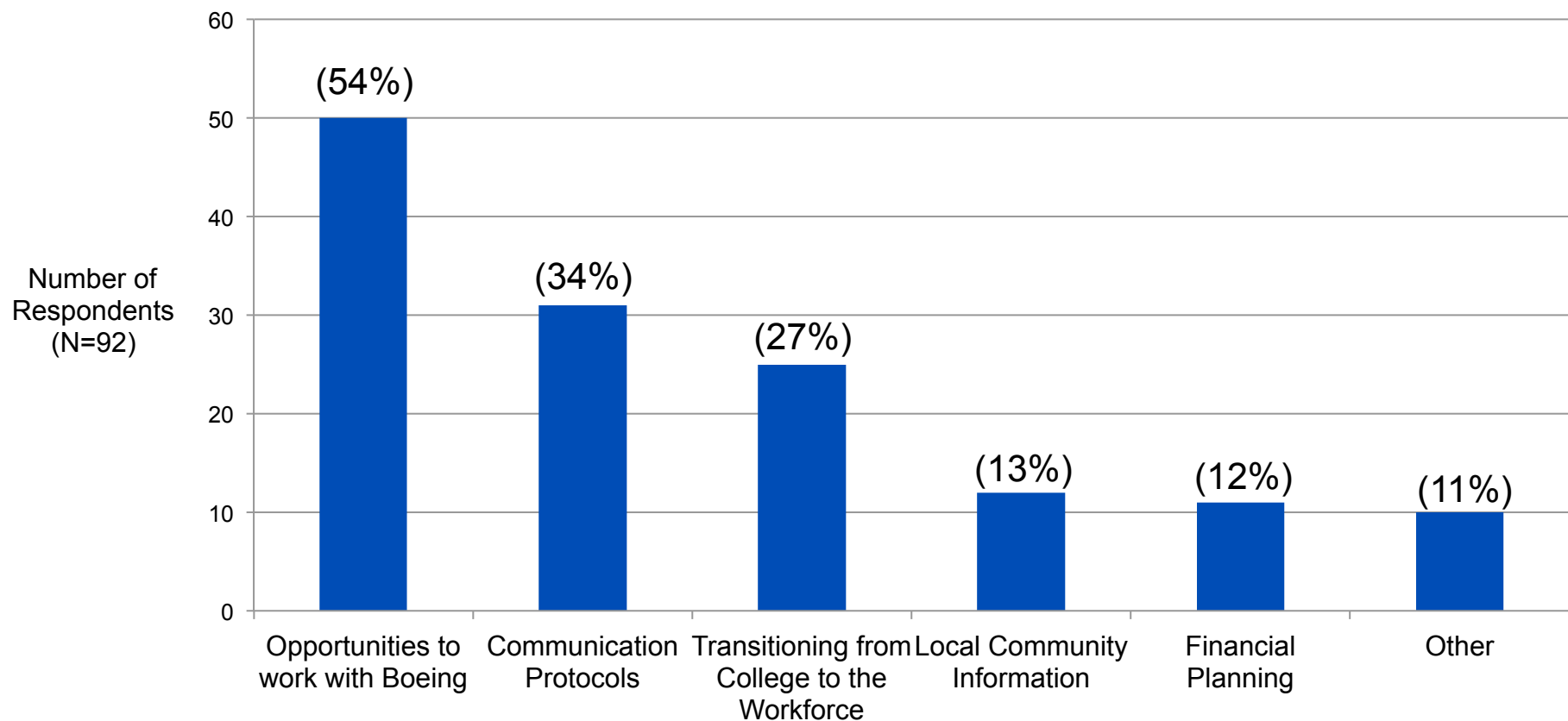
Results of Mentoring Best Practices Survey

Help With Particular Technical Skills
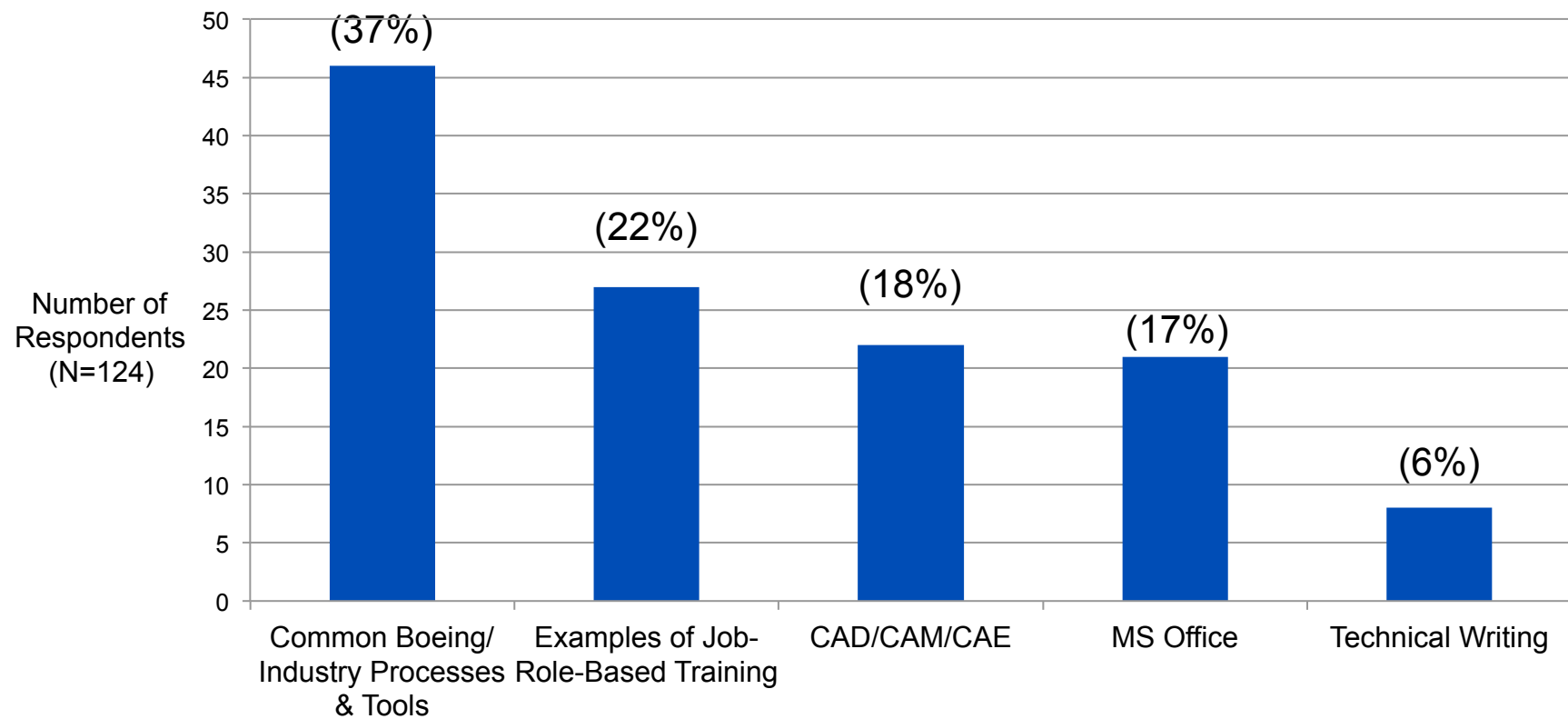
Number of Respondents (N=124)

Bar chart values:
- Common Boeing/Industry Processes & Tools: (37%)
- Examples of Job-Role-Based Training: (22%)
- CAD/CAM/CAE: (18%)
- MS Office: (17%)
- Technical Writing: (6%)

Results of Mentoring Best Practices Survey

Workplace Challenges

Bar chart titled "Workplace Challenges". Y-axis: "Number of Respondents (N=118)", scale 0 to 60.

- Dealing with Co-workers: 48 (41%)
- Workload / Type of Work: 24 (20%)
- Navigate Through Workday: 18 (15%)
- Work/Life Balance: 18 (15%)
- Other: 10 (9%)
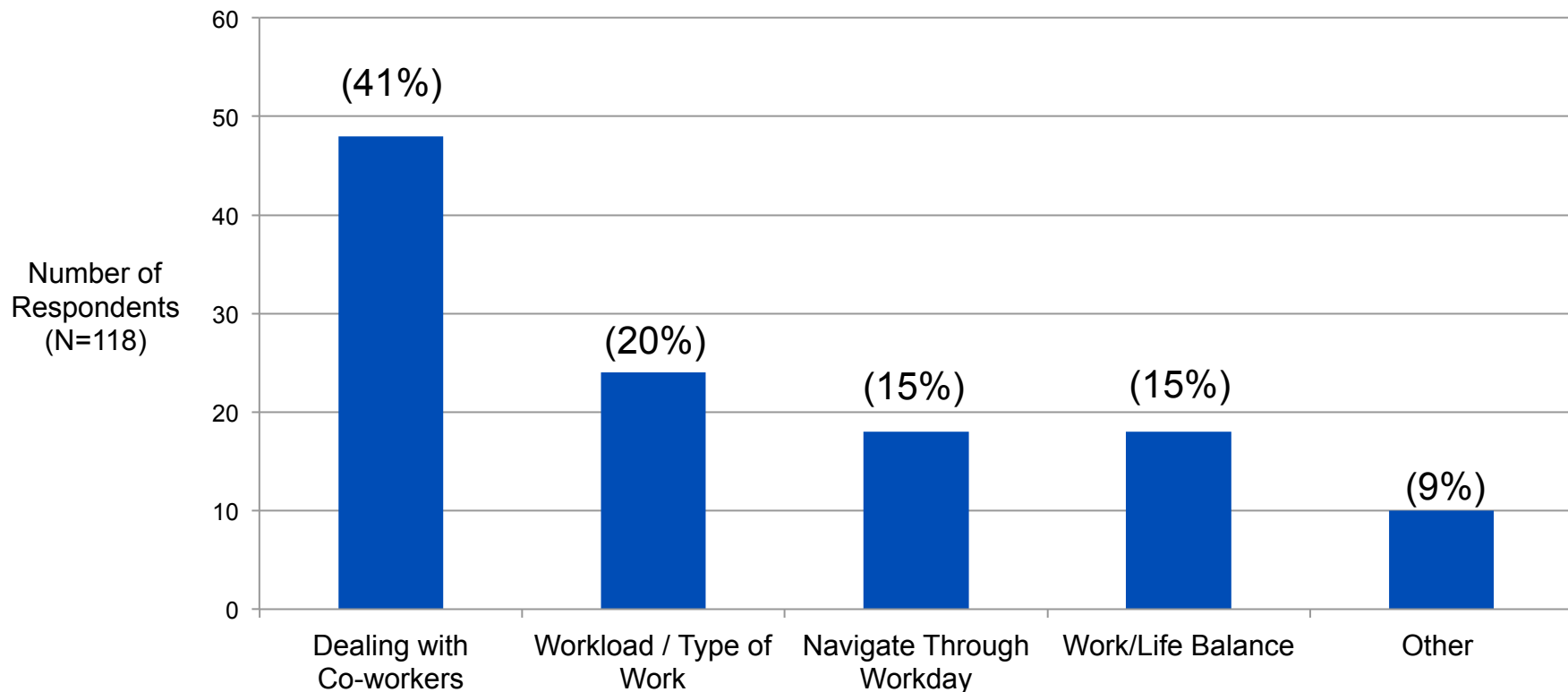
Results of Mentoring Best Practices Survey

Help With Soft Skills

Number of Respondents (N=126)

- Resume/Interview Skills (46%)
- Project Management (24%)
- Running Meetings (14%)
- Presentation Skills (11%)
- Others (5%)
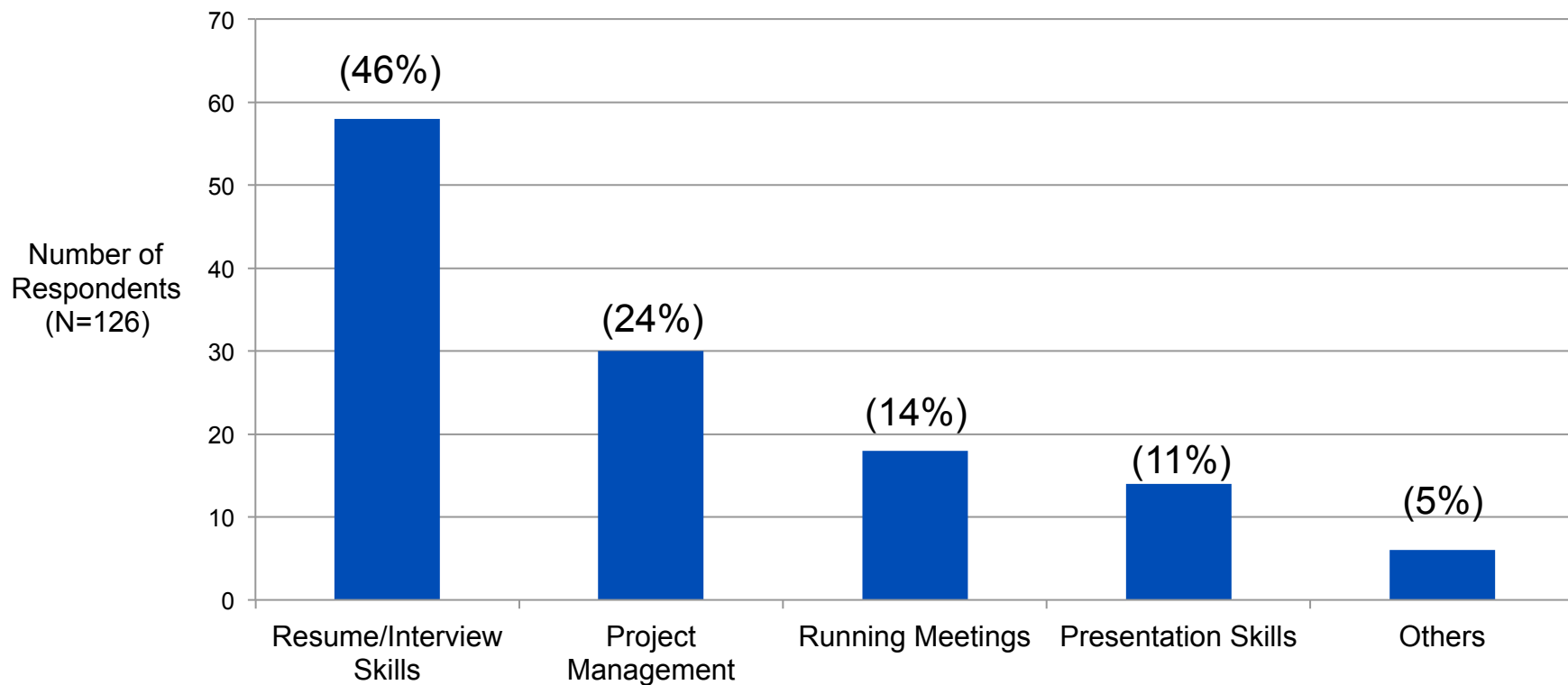
Structure for Meetings

Results of Mentoring Best Practices Survey

Formal agreement/plan to direct mentoring activities?
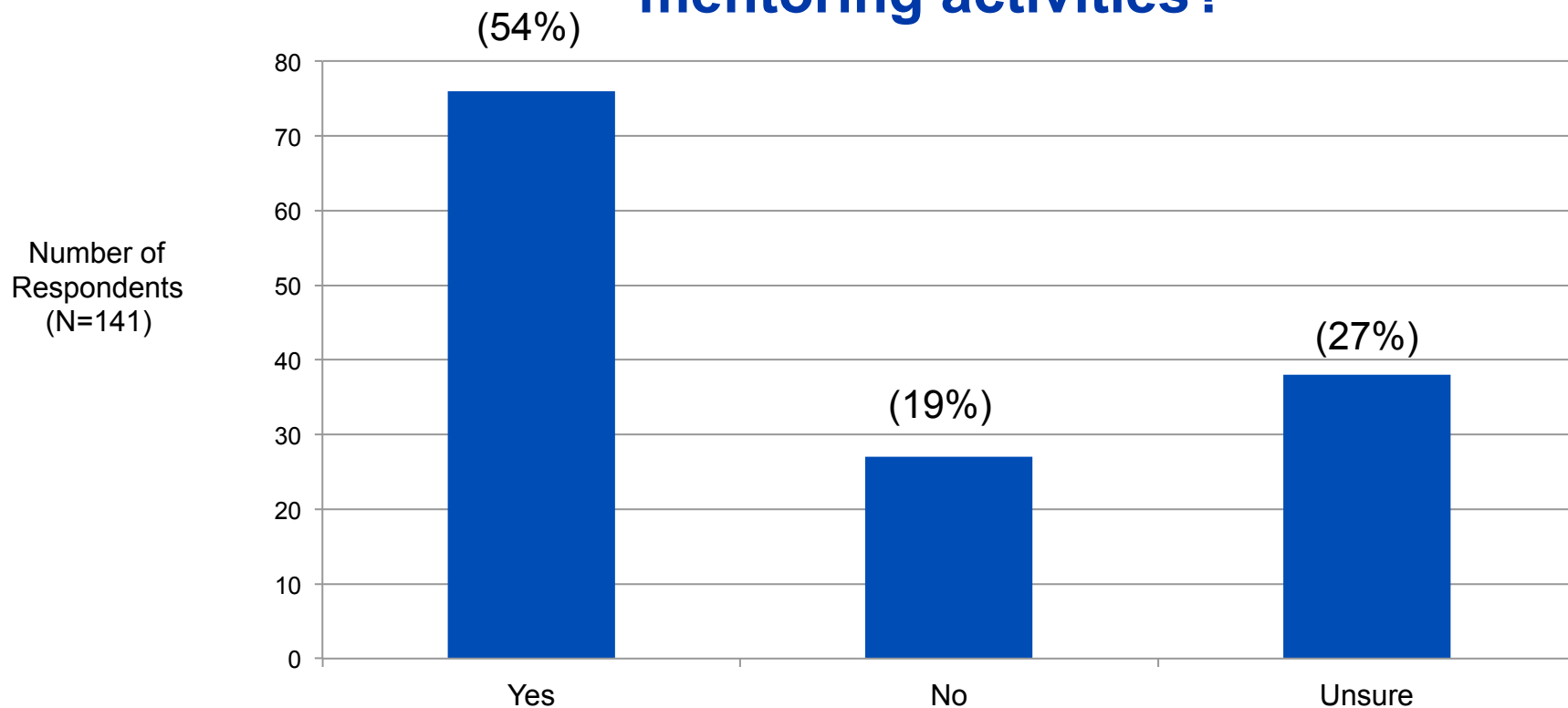
Number of Respondents (N=141)

(54%)
(19%)
(27%)

Yes
No
Unsure

Results of Mentoring Best Practices Survey

Who should guide/direct mentoring relationships?
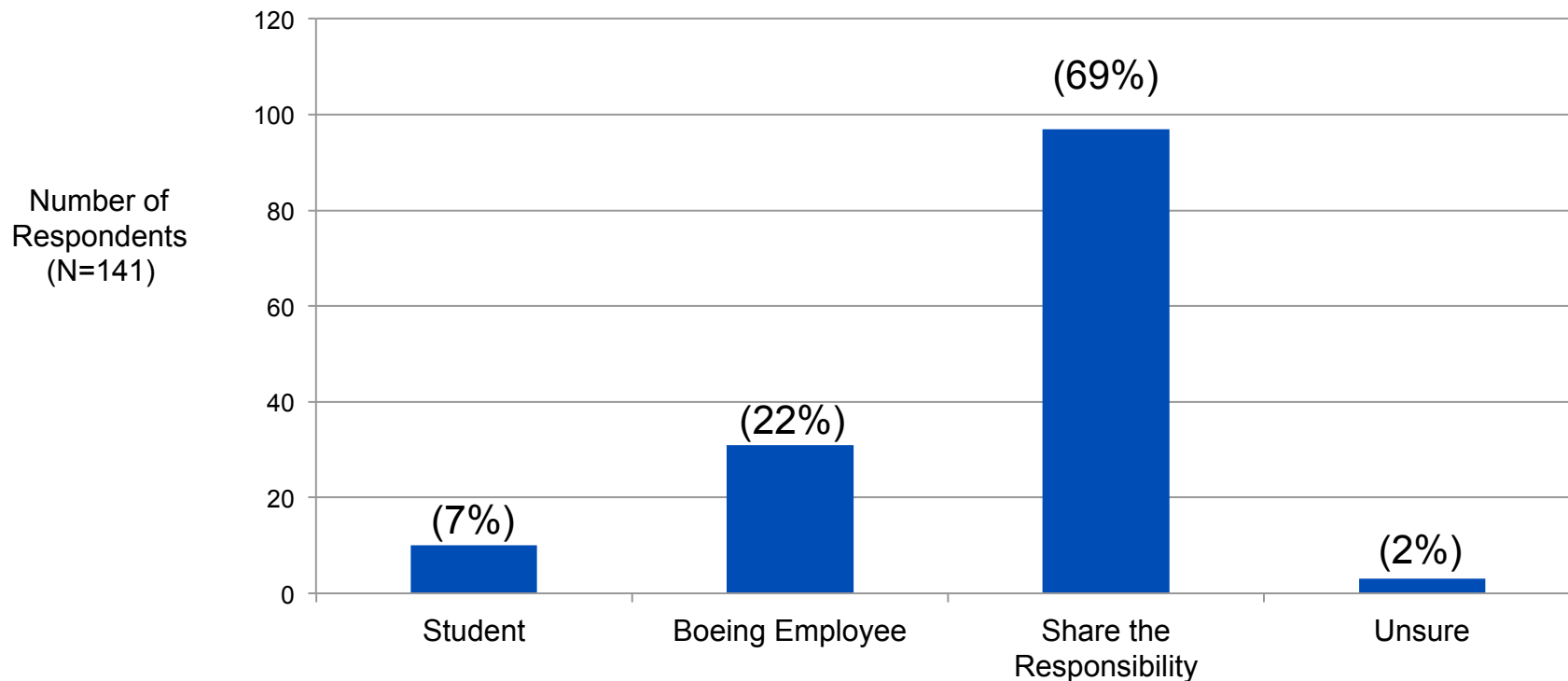
Number of Respondents (N=141)

- Student (7%)
- Boeing Employee (22%)
- Share the Responsibility (69%)
- Unsure (2%)
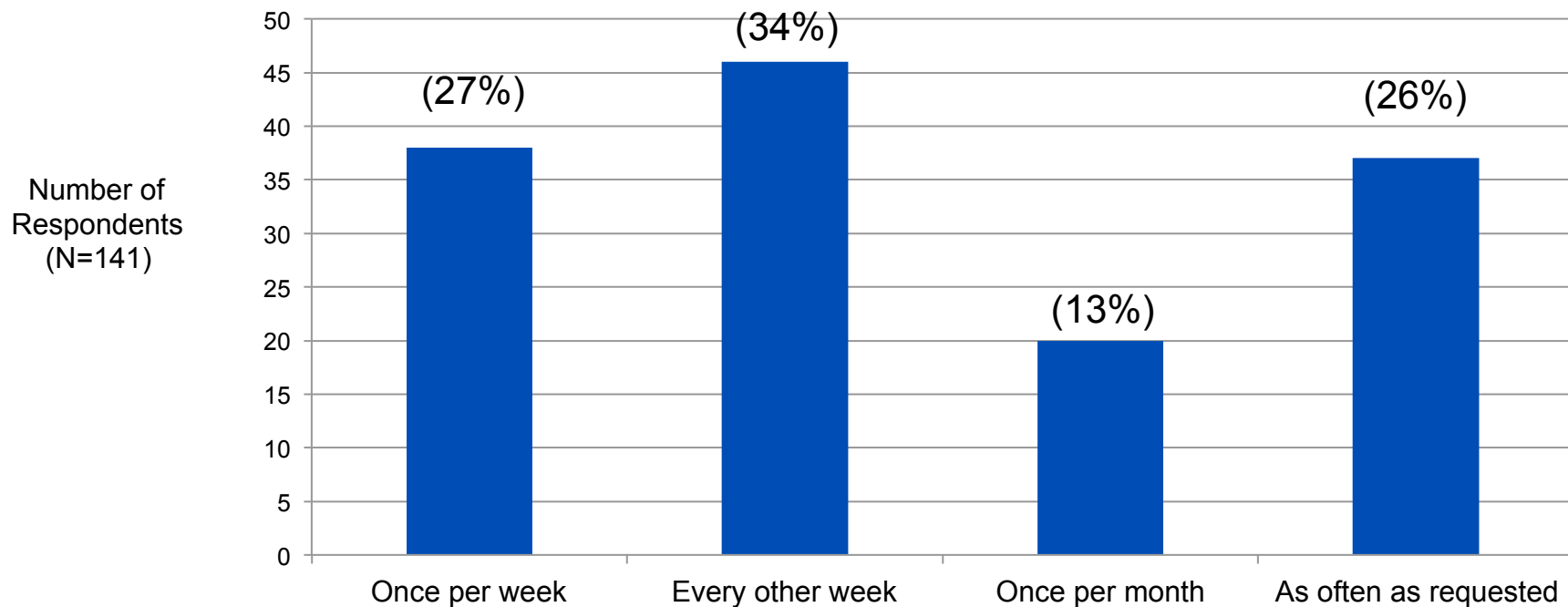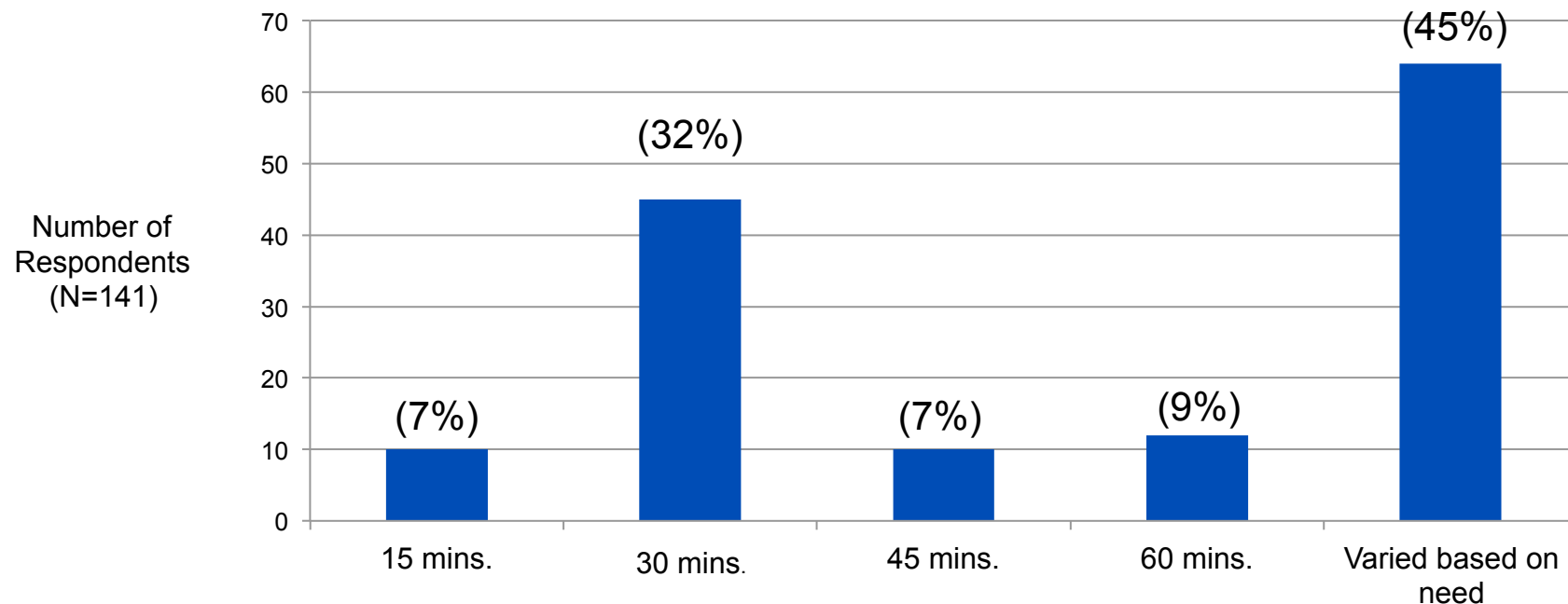
Results of Mentoring Best Practices Survey

How long should formal mentoring relationships last?
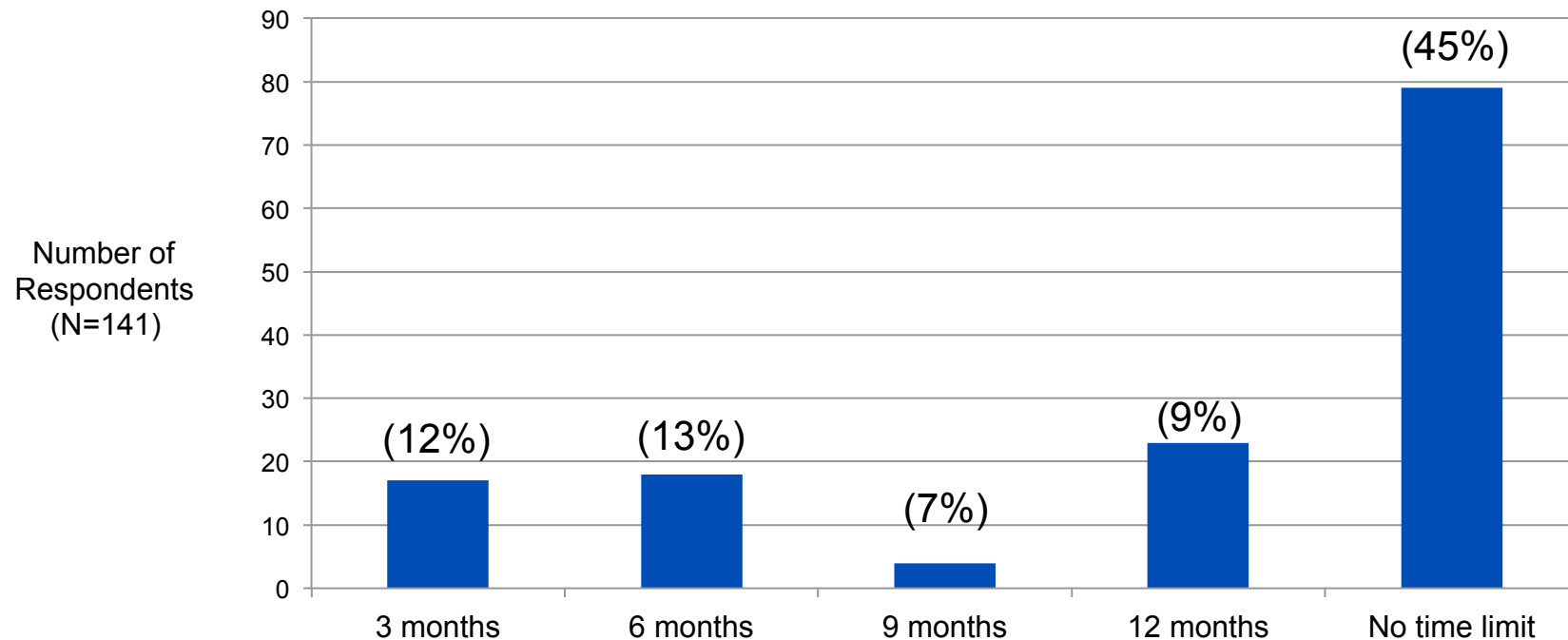
Number of Respondents (N=141)

Bar chart showing:
- 3 months: ~17 (12%)
- 6 months: ~18 (13%)
- 9 months: ~4 (7%)
- 12 months: ~23 (9%)
- No time limit: ~79 (45%)
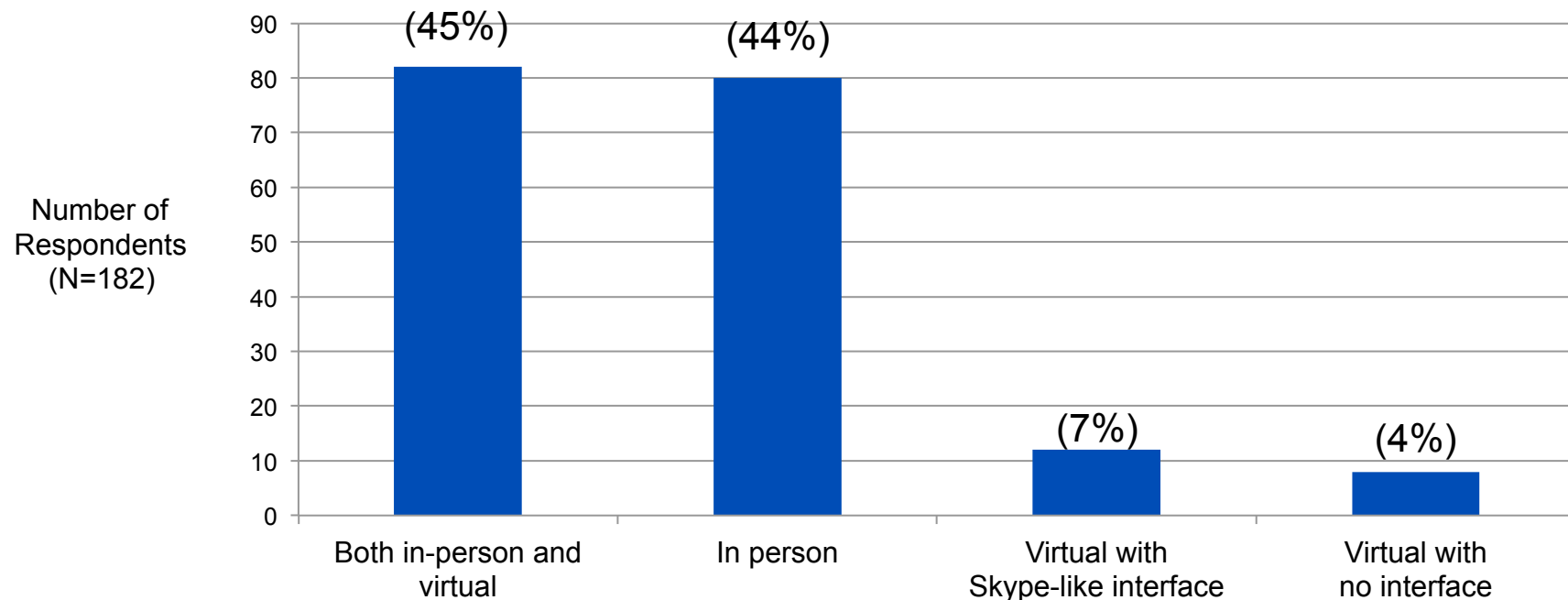
Results of Mentoring Best Practices Survey

Should mentoring relationships accommodate unplanned/emergent contacts?
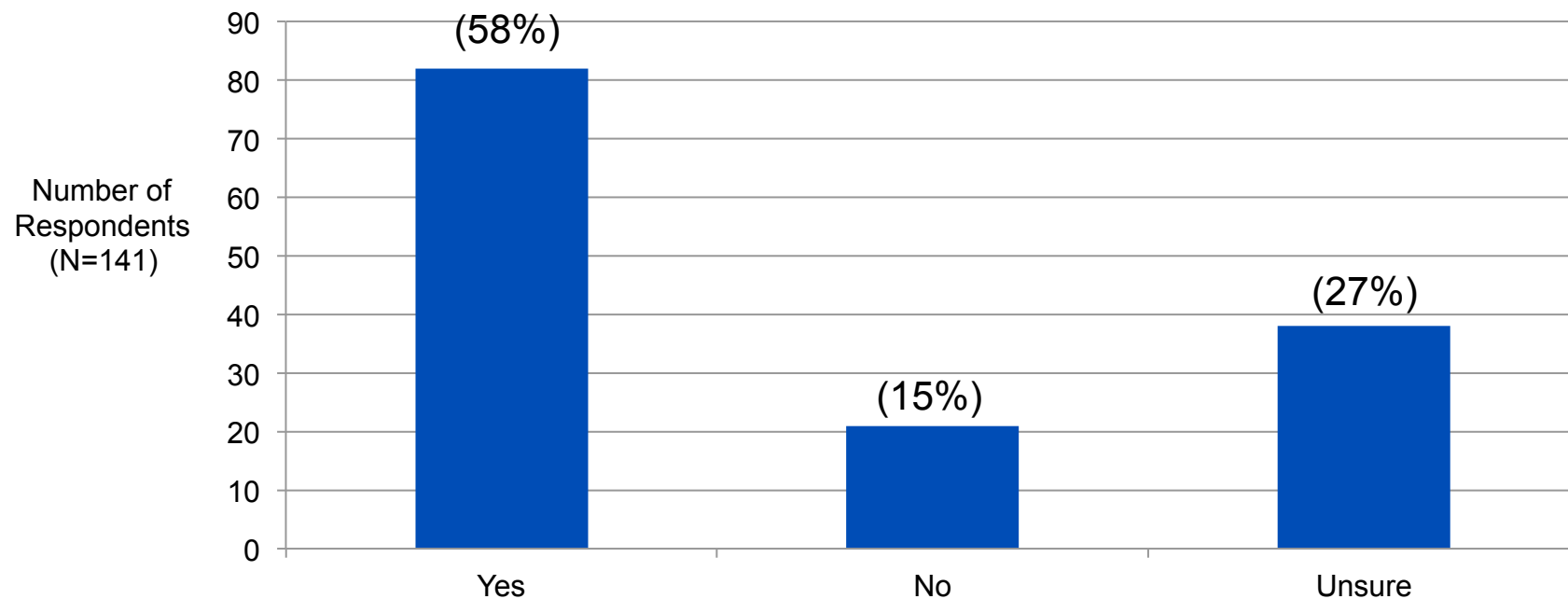
Number of Respondents (N=141)

Chart showing survey responses:
- Yes: ~82 (58%)
- No: ~21 (15%)
- Unsure: ~38 (27%)

Results of Mentoring Best Practices Survey

Additional Suggestions:

- Be prepared and ask LOTS of questions
- Put time into it or nothing will come of it
- Respect is earned through hard work and dedication
- Be open-minded, sincere, and friendly
- Be proactive at initiating and sustaining the relationship
- Mentoring goes both ways

Summary of Mentoring Best Practices Survey

Produced mentoring best practices guideline for coaches as derived from survey and InSite responses:

Content:

- **Career Development/Advice**
- **People Networking**
- **Technical Skills Development**
- **How Boeing Business Engine Runs**
- **Workplace Culture**
- **Opportunities to work with Boeing**
- **Communication Protocols**
- **Transitioning from college to the workforce**
- **Dealing with co-workers**
- **Workload management**

Summary of Mentoring Best Practices Survey

Produced mentoring best practices guideline for coaches as derived from survey and InSite responses:

Structure:

- Formal agreement/plan in place
- Share responsibility for guiding/directing relationship
- Bi-weekly meetings
- 30 minute meetings, but longer/short as needed
- Accommodate emergent meetings
- Virtual and/or In-Person meetings
- No limit on length of mentoring relationships

Next Steps

**Follow-on survey to evaluate mentoring
relationships at end of Capstone Course
(April 2015)**

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