

THE HUMAN FACTOR

THE HARD TIME EMPLOYERS
HAVE FINDING SOFT SKILLS

BURNING GLASS TECHNOLOGIES





EXECUTIVE SUMMARY

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BURNING GLASS
11.2015

Foundational or “soft” skills occupy an unusual position in the debate over America’s workforce. Employers say these skills are hard to find, but they are also notoriously hard to define. Soft skills are called crucial and then treated dismissively in the next breath, as if these were abilities any child should have. “Works well with others” is a cliché on a school report card, but businesses grind to a halt when employees can’t meet deadlines, treat customers with respect, or waste time scrambling to properly format a document.

In this report, we try and define these skills based on what employers actually demand in job postings, and measure how difficult they are to find in the job market. Essentially, we have let employers speak for themselves. A skill requested in job ads across almost every industry and occupation, regardless of its actual requirements, is clearly a baseline qualification in the job market. And when employers demand a skill in a way that’s out of proportion to the traditional definitions of what a job requires, it’s likely that skill is both important and hard to find.

OUR FINDINGS BASED ON AN ANALYSIS OF MILLIONS OF JOB POSTINGS ACROSS THE UNITED STATES, WE FOUND:

1 in 3 SKILLS

On average, one in three skills requested in job postings is a “baseline skill.” Baseline skills are in high demand by employers, although the proportion depends on the particular industry. Even in the most technical career areas (such as IT, Healthcare, and Engineering), more than a quarter of all skill requirements are for baseline skills.

Baseline skills aren't limited to “people skills.” Certainly skills like customer service and organizational skills appear across the board in job postings, but so do skills like writing, as well as knowledge of specific software packages like Microsoft Word and Excel.

Employers appear to face real skill gaps in finding the baseline skills they need. We compared the emphasis placed on specific skills in job postings with what their actual importance should be, as determined by standard government occupational profiles. A number of baseline skills are overemphasized in the recruitment process—suggesting they are under-supplied in the candidate pool.



Writing, communication skills, and organizational skills are scarce everywhere. These skills are in demand across nearly every occupation—and in nearly every occupation they're being requested far more than you'd expect based on standard job profiles. Even fields like IT and Engineering want people who can write.

Lower-skill jobs seem to face the widest gaps in baseline skills. Employers in fields such as Hospitality, Food and Tourism; along with Personal Care and Services; make particularly strong calls for skills like basic math.

Different occupations demand a different mix of baseline skills. There's a perception that baseline skills are a universal skill-set needed in any workplace. In fact, while it's true that all baseline skills are in demand, we found the specific set of skills employers want varies considerably--and predictably--from occupation to occupation. There are clusters of baseline skills for every occupation. For example, Design jobs emphasize writing, creativity, and attention to detail; but place less emphasis on customer service or management skills. By contrast, Operations jobs are more likely to demand project management, supervisory, or problem-solving skills.



Baseline skill gaps may be specific to a particular career—but not necessarily core skills in the field. Often, these gaps represent skills that are not covered in traditional training programs, but which are still critical to performance. For example, math skills are particularly emphasized in customer service and hospitality / food service job postings, where workers are less likely to have developed quantitative skills. IT employers, by contrast, are more likely to emphasize customer service or leadership skills.



INTRODUCTION

THE HUMAN FACTOR

EVERY JOB AD IS A WINDOW INTO THE REAL WORLD OF THE LABOR MARKET

because it forces employers to articulate, in their own words, what they need from workers and how they expect to get it. A job ad has real stakes attached.

A fundamental question in the modern, increasingly automated job market surrounds the importance of foundational or “soft skills.” Human interaction has proven decidedly difficult to computerize, and many economists believe the labor market is placing increasing value on social and other non-technical skills. Recent studies from [Harvard¹](#) and [Stanford²](#) have found that jobs with high social skill requirements have experienced greater wage growth than others. In addition, employment and wage growth has been strongest in occupations which require both strong social skills and a high level of cognitive skills.

Yet what skills, exactly, do employers need? How do they frame these needs when it actually comes to hiring workers? Are they able to find workers who have those skills? If not, what soft skill gaps are most severe and how do these vary across different types of work?

These are questions that job postings are uniquely positioned to answer. This report, based on analysis of Burning Glass’s database of real-time job data, looks at the baseline skills that employers most commonly request in employment ads. Baseline skills – sometime called foundational skills - are defined here as the common, non-specialized skills that cut across a broad range of job types. Baseline skills include communication, problem solving, detail-orientation, and creativity, but also things like basic computer literacy that increasingly represent a minimum qualification for even low-wage jobs.

In this report, we analyze how skill demands vary across job function, showing which skills are most important by job group. This information can aid students and job seekers in selecting occupations that make the most of their interests and in identifying potential gaps that can be filled with additional training or professional development.

Then we identify skills where employers face gaps in the market, indicating areas where job seekers can stand out and where training programs should focus to increase the job market prospects for their graduates. Certain skills, however, show gaps almost across the board. Clear communication, particularly writing, is at a premium in nearly every occupation. Basic mathematics, as well as the ability to manage other workers and customers, are also in short supply—although some occupations suffer more than others.

¹ “The Growing Importance of Social Skills in the Labor Market,” Deming, D, NBER Working Paper, 2015, www.nber.org/papers/w21473

² “The Payoff to Skill in the Third Industrial Revolution,” Liu, Y, and Grusky, D. American Journal of Sociology, 2013, www.jstor.org/stable/10.1086/669498

Other research—such as several recent surveys of employers—has suggested that when employers speak of the “skills gap” they are just as concerned about baseline skills, like critical thinking, as about the latest programming or technical skills.¹ But you can’t solve a problem until you define it. Educators and workers can’t provide these skills until they know what those skills are. By examining job postings, we can move a step closer to understanding how this concern actually plays out in practice, occupation by occupation. Armed with that knowledge, educators, employers, and workers can take concrete steps to solve an inherently fuzzy challenge.

HOW EMPLOYERS ADVERTISE BASELINE SKILLS

The importance employers place on baseline skills is evident in the ways that they post jobs and advertise for talent: across all career areas, one in three skills that employers advertise in job postings are baseline skills. Even in highly technical jobs like Healthcare and Information Technology, baseline skills account for one in four skills requested by employers.

Baseline skills are most emphasized in roles that involve higher levels of personal interaction relative to technical activities. In Customer Support roles, over half of all requested skills are baseline skills. Clerical and Administrative, Human Resources, Hospitality, Sales, and Management are the other areas where employers place the greatest emphasis on baseline skills.

The first analysis in this report uses a ranked list of baseline skills specified in 25 million jobs posted over the last year to determine the skills that are most valued by employers in each job family. The vocabulary of baseline skills is relatively limited – most jobs, after all, require some level of communication and problem solving – so this approach highlights clear employer preferences that vary from job to job. For example, Creativity is far more commonly requested in Design, Media, and Writing jobs (ranked #3 compared to #19 in the market overall) and being Detail-Oriented is more requested in Finance jobs (#6 vs #11 overall).

The second analysis in this report focused on the baseline skills that employers seem to have trouble finding within their existing candidate pool. We can calculate skills gaps by comparing the frequency that employers ask for a skill in job postings – a measure of the importance they put on recruiting candidate with that skill – with the level of importance of the same skill according to the objective job profiles in the O*NET skills database sponsored by the U.S. Department of Labor, we can identify potential gaps. Skills which are listed in posting with a frequency that is out of proportion with their measured importance according to O*NET are likely to represent gaps in the market.

**1 in 4
SKILLS**

BASELINE SKILLS

Even in highly technical jobs like **Healthcare and Information Technology**, baseline skills account for one in four skills requested by employers.

¹ “Closing the Skills Gap,” Lumina Foundation, 2014, //www.luminafoundation.org/files/publications/Closing_the_skills_gap.pdf; and “The Role of Higher Education in Career Development: Employer Perceptions”, Chronicle of Higher Education, 2012, chronicle.com/items/biz/pdf/EmployersSurvey.pdf

It is important to note that job postings don't include a comprehensive inventory of the skills required for a given job. When crafting a job ad, employers mention skills selectively to attract candidates who possess the skills they need and filter out those who don't.

It may seem counterintuitive, but in job ads employers are actually more likely to mention skills they're worried won't be commonly available in their candidate pool. For example, basic mathematics is ranked highest as a baseline skill in hospitality and manufacturing jobs. People in these roles need math proficiency – typically for basic finance in hospitality and taking measurements in production roles – yet many otherwise well-qualified applicants may be missing these skills. By contrast, mathematics skills are rarely mentioned by employers looking to hire candidates into technical roles in Finance and Engineering. The ability is just as crucial, but it's also assumed that an engineer has that skill.

The data in this report represent an analysis of nearly 25 million unique job postings collected over a one-year period from September 2014 to August 2015. This report focuses on the 28 most commonly requested baseline skills which cover 97% of all baseline skill requested in job postings. Postings are then parsed to extract information on occupation and skills requirements used in the analyses described below. Full details are in the Methodology section.

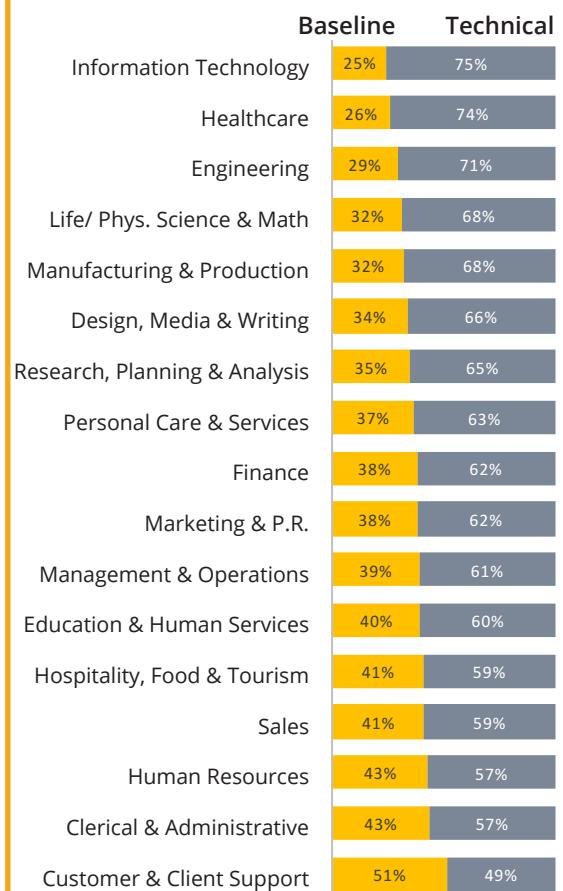
SOFT SKILLS VS. HARD SKILLS VS. BASELINE SKILLS

In this report, we've favored the terms "baseline skills" and "technical skills" over the widely used concepts of "hard" and "soft" skills. The definition of soft skills is, as the name implies, somewhat fuzzy. Hard skills are usually defined as technical skills that can be formally taught, such as programming or bookkeeping. Soft skills thus become intuitive "people skills," often considered part of emotional intelligence. But many programs exist to train people in soft skills like customer service, while many hard skills are often self-taught.

We have effectively let employers define baseline skills by analyzing what they request most often in job postings. We defined skills sought by employers across multiple occupations and that are not typically taught in training programs as a baseline skills. That includes many soft skills, certainly, but also skills like Microsoft Word and Excel. People can be formally taught to use these software packages—but far more learn to use them on their own.

Technical skills, for our purposes, means skills that both can be taught and that are specific to a particular occupation or industry. For example, software programs ranging from Adobe Photoshop to SPSS may be either self-taught or learned in a formal setting, but the demand for these skills is limited to specific roles and industries.

TECHNICAL VS. BASELINE SKILLS BY OCCUPATIONAL GROUP



OCCUPATIONS REQUIRING +70% TECHNICAL SKILLS



Information
Technology



Healthcare



Engineering

OCCUPATIONS REQUIRING +40% BASELINE SKILLS



Education &
Human Services



Hospitality, Food
& Tourism



Sales



Human
Resources



Clerical &
Administrative



Customer &
Client Support

BASELINE SKILLS IN DEMAND BY OCCUPATIONAL FAMILY

SKILL	CAREER AREA	OVERALL														
		Clerical & Administrative	Customer & Client Support	Design, Media & Writing	Engineering	Finance	Healthcare	Hospitality, Food & Tourism	Human Resources	Information Technology	Management & Operations	Manufacturing & Production	Marketing & PR	Personal Care & Services	Research, Planning & Analysis	Sales
Communication Skills	#1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1
Organizational Skills	2	3	3	4	3	3	2	2	2	3	2	2	2	2	2	3
Writing	3	6	5	#1	2	4	3	4	5	2	3	3	3	3	4	4
Customer Service	4	8	#1	15	12	7	9	3	11	9	11	14	12	5	11	2
Microsoft Excel	5	2	9	9	8	2	12	16	3	10	6	6	5	16	3	9
Word + Office	6	4	8	7	5	5	10	13	4	8	8	5	9	15	7	6
Problem Solving	7	12	6	10	6	8	7	12	7	4	7	4	11	10	5	7
Planning	8	14	18	13	7	12	5	10	10	5	4	8	4	7	8	11
Comp Skills + Typing	9	5	4	17	10	10	4	8	12	24	14	7	17	9	16	8
Research	10	10	12	5	9	9	6	21	8	7	12	13	6	12	6	18
Detailed-Oriented	11	7	7	6	11	6	14	9	6	11	13	9	10	19	10	12
Building Effective Relationship	12	15	11	19	17	11	11	6	9	15	9	18	13	3	13	5
Project Management	13	24	24	11	4	17	19	37	14	6	5	12	8	29	9	22
Supervisory Skills	14	18	20	25	14	14	8	5	18	26	10	11	23	8	26	14
Multi-Tasking	15	9	10	12	19	13	15	11	13	13	18	15	16	18	14	13
Time Management	16	16	13	14	26	15	16	19	15	21	19	20	20	14	19	10
Leadership	17	33	23	21	15	26	18	14	24	12	15	17	22	17	17	17
Mathematics	18	22	15	27	13	18	25	7	35	20	31	10	32	13	18	16
Creativity	19	30	26	3	22	27	22	20	16	14	17	26	7	21	22	20
Presentation Skills	20	35	21	16	23	22	23	32	17	16	16	27	14	31	15	15
Team Work	21	20	19	18	21	23	21	15	21	17	24	19	15	22	21	19
Analytical Skills	22	31	28	29	27	16	32	36	23	18	22	21	21	36	12	31
Bilingual	23	23	14	23	34	20	17	24	22	39	29	25	31	23	36	24
Meeting Deadlines	24	19	27	8	28	19	31	28	19	25	26	22	18	25	20	29
Self-Starter	25	27	29	20	24	25	38	34	25	22	28	24	19	30	23	21
Listener	26	34	16	31	37	24	20	22	32	32	34	29	33	6	33	23
Critical Thinking	27	36	36	34	39	29	13	45	38	29	38	38	35	37	28	39
Positive Disposition	28	29	22	24	36	32	28	17	33	37	40	28	28	11	41	25

Figure 2: Baseline Skills Ranked by Career Area

TOP BASELINE SKILLS

The table at left shows a ranked list of top baseline skills by career area, highlighting those skills which are more commonly requested, and thus more valued, for each particular group of jobs. For example, Relationship Building is the third-most-requested baseline skill in external-facing Sales and Marketing jobs, but falls to 19th overall in Design and Media roles, behind even more STEM-intensive fields.

SKILLS GAP FOR BASELINE SKILLS

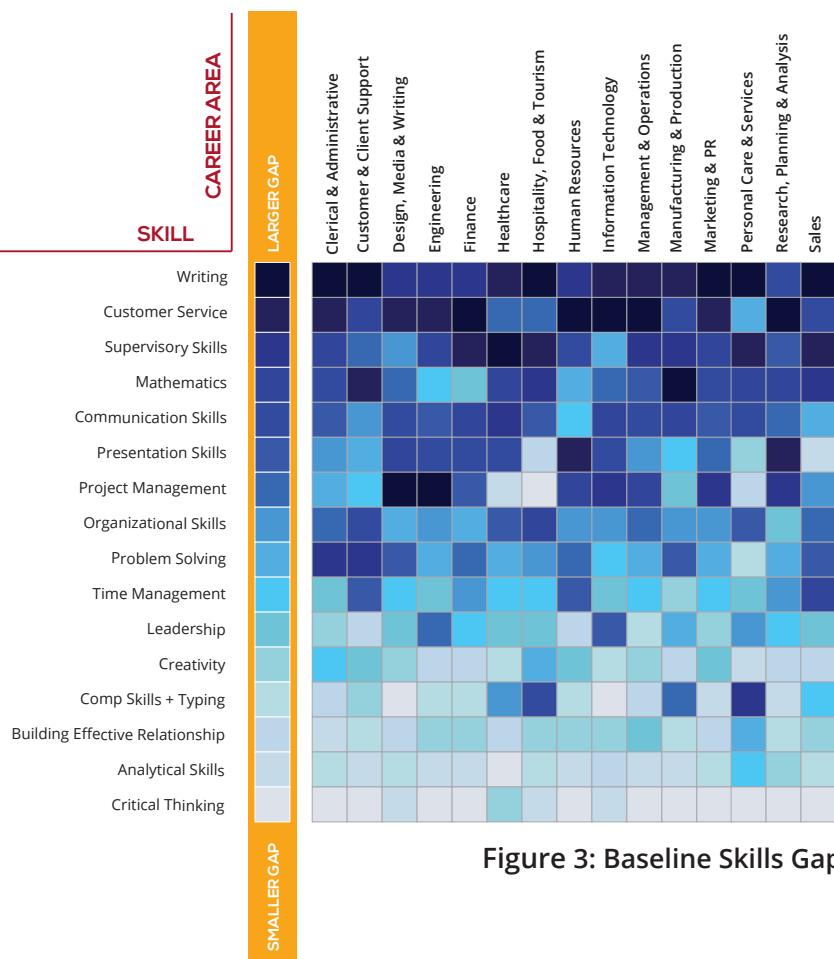


Figure 3: Baseline Skills Gap

The fact that employers are willing to devote a sizeable space in their job postings to spell out these baseline skills suggests that these skills are both highly valued and potentially under-supplied. To assess whether a gap exists and its magnitude, we compared how often employers requested the skill in ads, with its importance in the day to day role as measured by O*NET job profiles – a federally-sponsored industrial-organizational occupational inventory. Skills which are overemphasized in the recruitment process are likely under-supplied in the candidate pool. (See appendix 1 for a detailed methodology). To visualize some of the most significant skill gaps, we present these skill-occupation combinations in **blue** in this color-coded diagram below. **Darker blue** indicates evidence of a larger skills gap.

The skills with the largest gaps are writing, customer service, supervision, basic mathematics and communication. Writing is particularly notable because of the frequency with which it crops up in postings by employers, ranking the #3 skill overall. Additionally, the gaps persist across nearly all occupation families.

In **Mathematics**, the gaps are most severe in occupations where the level of math requirements are relatively low but where math skills are nonetheless essential to successfully completing the job. The two categories with the largest mathematics skills gap are Hospitality, Food and Tourism, and Manufacturing and Production. The chart below plots skill gaps against the skill level as defined in the ONET database.

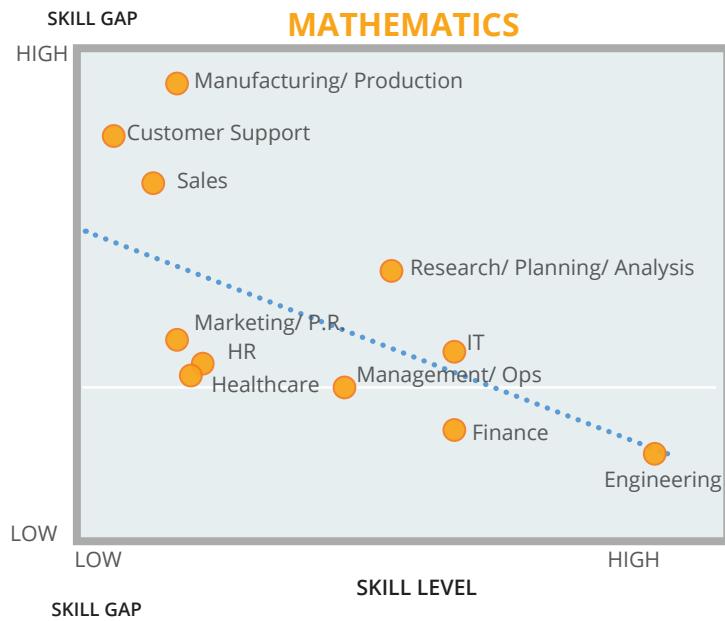
In **Writing**, skill gaps exist in jobs requiring a broader range of writing skill levels. As with math, we see gaps among jobs with the lowest skill requirements such as hospitality and customer support. However, in this case we also see gaps in more writing intensive jobs such as Sales; Marketing and Public Relations; and Information Technology.

Supervision has its largest skill gaps in Hospitality, Food and Tourism; Personal Care and Services; and Manufacturing and Production. In Hospitality and Personal Care, skill requirements are low and turnover is high, which would likely both create challenges for managers and shortages of talent. **Communication** also has its largest gaps in these three fields.

Customer Service shows a different pattern. There is no skill gap here in several fields where this could be critical, such as Personal Care and Healthcare. But the gaps are significant in occupations like Finance; Information Technology; and Clerical and Administrative.

Some baseline skills, otherwise not among the largest problem areas, are significant problems in specific occupations. **Time Management** has its largest skills gap in Sales, while **Problem Solving** is in short supply in both Customer Support and Clerical and Administrative occupations.

One area where we don't find specific evidence of a gap is in critical thinking or analytical skills, which the Labor Department considers highly important across all jobs, but are relatively sparsely requested in job postings. One possible explanation is that it isn't easy to assess whether a candidate has critical thinking skills during a job application process, and so that discourages employers from requesting this skills in postings. Another possibility is that critical thinking is assumed to go along with certain levels of education (a bachelor's degree, for example).



COMMUNICATION, ORGANIZATION AND WRITING: UNIVERSALLY REQUESTED BASELINE SKILLS

Communication, Writing, and Organizational skills are commonly requested across nearly all jobs families and skill levels. They are the top three requested baseline skills overall and fall in the top five skills for every occupation family. The remainder of the top 10 most requested skills overall are Customer Service, Microsoft Excel, Problem Solving, Planning, Microsoft Word, Research and Computer Literacy.

Writing is the third most requested baseline skill overall and has the largest overall gap among the baseline skills studies in this report. Writing is in consistently high demand across all kinds of jobs, including occupations which are not typically thought of as requiring literary talent. It is the second-most-requested baseline skill for Engineering and IT Occupations, for example, and even among "low-skill" jobs (those paying less than a national living wage) it comes in fourth.

Employers show gaps in writing skills across the occupational spectrum. Large gaps appear in roles that have clear and obvious writing requirements, such as marketing, and also occupations where the writing requirements may be less obvious such as IT roles, where programmers are often required to write technical documentation and support professionals must communicate fixes and procedure to clients. Sales is another area where this skill is in demand, since writing strong proposals and compelling pitch messages are critical to closing deals. Strong writing skills can set a job seeker apart when entering these fields.

BASIC COMPUTER SKILLS ARE REQUIRED ACROSS THE MARKET

Similarly, basic computer skills are in demand across the entire job market. In an increasingly technical workplace, workers across all occupation families are expected to be proficient in a range of digital skills. Nearly two-thirds (65%) of all online job postings are in occupations where employees are expected to possess digital skills. Those numbers increase to 78% for middle-skill occupations and 83% for high-skill occupations.²

Employers treat the software programs Microsoft Word and Excel as baseline skills and they are commonly expected across a broad range of occupation groups. They are among the top 10 most-requested skills overall, mentioned more often than other common workplace skills such as attention to detail and project management. More than one in three of all jobs are in occupations commonly requesting Microsoft Excel (38%) and Microsoft Word (34%).

Manufacturing and health care jobs are typically less software intensive, but employees are still expected to be able to retrieve and record data from an online inventory system or electronic health record systems. In those cases, employers tend to request Computer Literacy rather than a specific software package. The largest skill gaps in computer skills are the three areas where the lowest level of skill requirements: Hospitality, Personal Care, and Manufacturing and Production.

2 In this analysis, low skill occupations are classified as those where the average wage is less than the national living wage of \$15.00 as specified by MIT Living Wage Calculator (<http://livingwage.mit.edu/>). Middle skills occupations are those occupations which pay more than a living wage and are generally open to sub-baccalaureate job seekers (<80% of postings required a BA). High skill occupations are classified as those which nearly always required a Bachelor's degree (>80% of job postings requesting a BA).

COMPUTER SKILLS

Most jobs demand knowledge of word processing and spreadsheets. Job seekers – particularly those seeking bachelor's level roles or entering office-based jobs – should ensure the Microsoft Office suite is a core part of their skill portfolio.

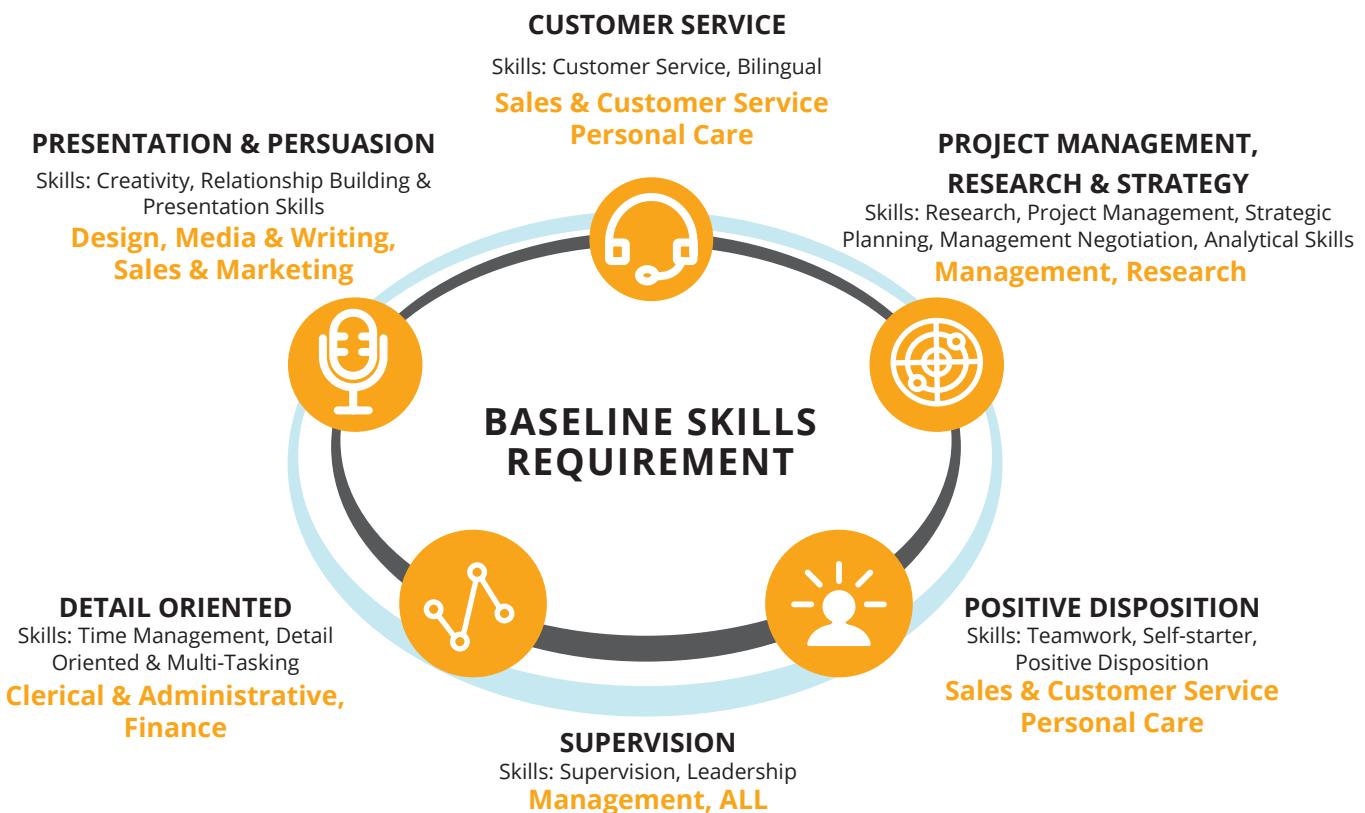




BASELINE SKILLS

BASELINE SKILL REQUIREMENT ACROSS JOB FAMILIES

Occupation groups commonly have a signature set of baseline skills that distinguish those roles. Burning Glass conducted a cluster analysis to determine which skills are commonly requested together in the same jobs. Through this analysis, job seekers can consider how their skills align with market opportunities and potential gaps to address in pursuing their desired careers.



PRESENTATION & PERSUASION CLUSTER



The presentation and persuasion skill cluster is most important in marketing, sales, design, and arts. A fundamental aspect of these roles is, of course, to persuade, whether through personal interaction (in the case of a salesperson) or using media (in the case of marketing). In today's media landscape, skills related to creativity often serve as proxies for persuasion, and vice versa. This cluster, particularly relationship building, is also heavily emphasized in Management and Human Resources roles.

Employers experience a gap in presentation skills in roles where internal presentations are commonly required duties such as Research, Planning and Analysis; IT; and Human Resources occupations. Job seekers targeting these career areas should emphasize presentation skills, since they have both important to employers and face gaps in the market.

CUSTOMER SERVICE CLUSTER



As would be expected, Customer Service (ranked #4 overall) is a top skill in service-oriented job families such as sales and hospitality. Less obviously, is it also a top skill (ranked #7) in Finance jobs where an increasing number of roles related to sales and retail banking where customer services skills are paramount. For example, openings in retail banking roles have grown 50% faster than openings in the Finance industry overall since 2010. This trend is driving open a gap in workers with the requisite combination of customer service skills and finance skills.

Labor market demand for a second language is driven primarily by business' need to service local multilingual communities. The jobs most commonly requiring non-English language skills customer-facing and caring roles such as sales representatives, bank tellers, nurses and other health professionals.

ATTENTION TO DETAIL & TIME MANAGEMENT CLUSTER



Attention to detail (or as it's often phrased in job postings, "being detail oriented") and related skills are most critical to employers hiring for Clerical and Administrative or Finance roles. Workers in these jobs typically must insure complete accuracy in invoices, balance sheets, and other sensitive documents.

For example, these skills are particularly critical for Executive Assistants, who typically manage multiple initiatives on behalf of their supervisors. In that role, multi-tasking and being detail-oriented stand near the top of the baseline skills requirements list, behind only organization, communication, writing and Microsoft Office.

POSITIVE DISPOSITION CLUSTER



A positive disposition is most commonly emphasized by employers in roles that involve dealing with the public, such as Sales and Customer Service, Personal Care, and Hospitality. Success in these positions is directly related to a worker's ability to connect with others, whether quickly forming a connection with a customer as a salesperson or building a long-term bond with a client as a personal care aide. To look at it another way, in these roles it does not take a lot of imagination to see the potential for disaster if a worker lacks a positive disposition.

PROJECT MANAGEMENT, RESEARCH & STRATEGY CLUSTER



Strategy and project management skills such as research, project management, negotiation and analytic skills are in particular demand among high-skill, high-paying jobs in families such as management and research. These jobs have experienced wage growth and expanded employment opportunities in recent years. Developing the skills in this cluster can be particularly advantageous to job seekers looking to advance their careers and take on additional responsibilities.

The jobs in this cluster commonly have a broad range of skill requirements, bridging complex analytic skills such as research and strategic planning, interpersonal skills such as management and negotiation, and the technical skills related to the particular industry or domain where the person works.

Our cluster analysis yielded surprising findings about skills that are commonly required together. Negotiation skills and analytical skills, which are not particularly similar skills, cluster closely together in the job market. They are most commonly requested among management occupations which play an important role in setting business strategy.

Project Management can serve as an important distinguishing skill for job seekers looking to advance. They areas where it is most required, in IT and in Engineers are also areas suffering the significant gaps. In Engineering roles, Project Management has the largest skill gap of all baseline skills. In addition to – or perhaps causing these gaps – employers are becoming increasingly specific about the project management techniques they want employees to know. In IT for example, we have seen a steady increase in the percentage of postings requesting knowledge of Agile and Scrum, two specific project management approaches. A quarter of Software Developer openings request either Agile or Scrum skills, up from just 10% five years ago.

SUPERVISORY SKILL CLUSTER



Supervisory skills are in demand – and facing skill gaps – across the job market. The gaps are widest in Finance, Hospitality, Sales, and Manufacturing and Production. To address this gap employers and employees likely need to work together with employers providing training for workers ready to advance from front-line roles to managerial ones.



IMPLICATIONS

For Job Seekers:

The good news for job seekers is that many of the skills discussed in this analysis are ones that people can learn as they advance in their careers. Certainly, some baseline skills such as relationship building, being detailed-oriented, and a positive disposition are heavily influenced by personality, and are harder for job seekers to change. However, the skills most commonly requested by employers – organization, communication, writing and computer skills — can all be learned by workers and built into education and training systems. And the skills that can help workers advance into managerial and other more advanced roles, such as negotiation and analytic skills, can also be learned, as they straddle the boundary between baseline skills and technical skills.

This means that job seekers should focus on demonstrating their proficiency in the skills employers most often request: organization, communication, writing, and basic computer skills, along with the specific technical requirements of field they are pursuing. Placing additional emphasis on skills where employers experience gaps will enable job seekers to distinguish themselves in a crowded job market.

Skills such as supervision, negotiation, analysis, research, and project management become increasingly critical for workers who want to advance into management. Developing experience in these areas will help job seekers make a case to employers that they have the skills needed to advance up the career ladder.

For Employers:

The burden should not entirely fall on job seekers, however. Thus far, employers have largely treated baseline skills like the weather: as an external factor in the labor pool that employers can't change. In fact, employers can provide development opportunities in many of these areas. The military, for example, explicitly seeks to instill skills like organization, leadership, and team building in recruits. While the military experience is much different than civilian employment, it does show that employers need not passively accept the skill levels the labor pool has to offer.

APPENDIX

APPENDIX 1: SKILLS GAP METHODOLOGY

AN ANALYTICAL FRAMEWORK TO IDENTIFY SKILL GAPS IN THE LABOR MARKET

We developed an analytical framework to map skill gaps in the labor market based on two factors: a skill's importance in an occupation, and how frequently it is requested in that occupation's job postings. Skill gaps are defined as skill-occupation combinations that are low in importance, and high in job posting reference.

DATA

Skill request frequency data were extracted from Burning Glass' job posting data for the past 12 months. We identified the top 25 most frequently requested baseline skills among those job postings. A skill's request frequency is measured by the percentage of job postings in which it is specifically called for. Among the top 25 baseline skills, their request frequencies vary between less than 1% and 64% across occupations.

Burning Glass collects online jobs postings from over 40,000 sources and parses each posting to extract the job title, occupation, skills requirements, certifications, salary, and other information contained within each. It then applies its rigorous deduplication algorithm to remove duplicates and places postings in a database for further analysis. This analysis leverages data from Burning Glass's skills taxonomy containing over 14,000 skills. Skills are standardized from a range of synonymous variants used in job postings. This analysis group occupations into functional career families based on its proprietary occupational taxonomy.

Skill importance data came from the U.S. Department of Labor's Occupational Information Network (O*NET). Sampled workers in the current workforce rated the importance of specific baseline skills in their occupations, from "not important" to "extremely important". Based on worker ratings, the O*NET importance measure is a continuous indicator, ranging from 1 - 5.

METHOD

Sixteen out of the top 25 baselines skills (64%) in the request frequency data were successfully matched to the importance data. They were then aggregated at the occupational family level, weighted by the number of job postings in each category.

Because the skill importance data and the request frequency data were in different scales, we proceeded with a procedure of data transformations based on their distributions. O*NET skill importance data's distribution closely resembled a normal distribution, and BGT skill request frequency data were right skewed. Therefore, we normalized the O*NET data and the log-transformed BGT data. The resulting scales are percentiles (0-1) fitted to a theoretical normal distribution based on their respective group average and standard deviation. The higher the number, the more important or more frequently requested the skill is, and vice versa.

We then calculated the distance between each pair of corresponding measures of importance and frequency. The term "skill gaps" refers to the specific cases where a skill is much more frequently asked for than its importance in the occupation would suggest, and the larger the number, the wider the skill gaps are. The following table presents all skill-occupation combinations, and the numbers represent the distance between measures of importance and request frequency. Skill gaps can then be identified as we compare the numbers, either within or across occupational families. For example, the widest skill gap is found to be writing in Hospitality, Food, and Tourism (.68).

Caution is warranted in interpreting the negative numbers in this chart. A negative value means a skill is of high importance in an occupation, but is referenced relatively less frequently in job postings. Negative numbers, therefore, do not necessarily indicate an oversupply of skill or may indicate an assumptive skill, cases which this method is not designed to identify. As a result, we solely focus on the largest gaps identified in this report.

APPENDIX2: DATA TABLES

The raw data used to compute the figures in the report is included here below:

FIGURE 1: BASELINE VS TECHNICAL SKILLS BY CAREER AREA

Career Area	Baseline Skills	Technical Skills
Information Technology	25%	75%
Healthcare	26%	74%
Engineering	29%	71%
Life/Physical Science and Math	32%	68%
Manufacturing and Production	32%	68%
Design, Media, and Writing	34%	66%
Research, Planning, and Analysis	35%	65%
Personal Care and Services	37%	63%
Finance	38%	62%
Marketing and Public Relations	38%	62%
Management and Operations	39%	61%
Education and Human Services	40%	60%
Hospitality, Food, and Tourism	41%	59%
Sales	41%	59%
Human Resources	43%	57%
Clerical and Administrative	43%	57%
Customer and Client Support	51%	49%

APPENDIX2: CONTINUED

FIGURE 2: BASELINE SKILL PERCENTAGES BY CAREER AREA

Baseline Skill	All Career Area	Clerical and Administrative	Customer and Client Support	Design, Media, and Writing	Engineering	Finance	Health Care including Nursing	Hospitality, Food, and Tourism	Human Resources	Information Technology	Management and Operations	Manufacturing and Production	Marketing and Public Relations	Personal Care and Services	Research, Planning, and Analysis	Sales
Communication Skills	37%	36%	46%	34%	34%	41%	28%	32%	43%	36%	43%	28%	46%	36%	42%	45%
Organizational Skills	27%	33%	28%	27%	22%	29%	20%	26%	40%	22%	38%	23%	37%	20%	33%	29%
Writing	23%	24%	22%	39%	23%	25%	15%	14%	28%	25%	26%	17%	34%	15%	30%	21%
Customer Service	17%	20%	64%	6%	6%	19%	8%	23%	14%	10%	15%	6%	13%	13%	11%	35%
Problem Solving	15%	11%	20%	11%	19%	17%	10%	8%	15%	21%	20%	17%	15%	6%	23%	13%
Building Effective Relationships	9%	7%	12%	5%	5%	12%	7%	11%	14%	5%	15%	5%	12%	18%	9%	15%
Project Management	9%	4%	3%	10%	21%	6%	2%	1%	10%	15%	24%	8%	21%	1%	19%	5%
Computer Skills	9%	15%	17%	5%	9%	11%	11%	7%	10%	3%	9%	12%	8%	6%	6%	11%
Supervisory Skills	7%	5%	4%	2%	6%	8%	9%	12%	6%	2%	15%	9%	7%	7%	4%	8%
Time Management	6%	6%	9%	7%	4%	7%	4%	5%	8%	4%	7%	4%	7%	6%	6%	11%
Mathematics	5%	5%	8%	2%	6%	6%	2%	9%	2%	4%	3%	11%	3%	6%	7%	7%
Leadership	5%	2%	3%	3%	6%	4%	3%	6%	4%	6%	10%	5%	6%	5%	7%	7%
Creativity	5%	3%	3%	29%	4%	3%	2%	5%	8%	5%	8%	2%	21%	4%	5%	5%
Presentation Skills	5%	2%	4%	6%	4%	5%	2%	1%	7%	5%	8%	2%	10%	1%	8%	8%
Analytical Skills	3%	3%	3%	2%	3%	7%	1%	1%	4%	5%	6%	3%	7%	0%	10%	2%
Critical Thinking	2%	1%	1%	1%	1%	2%	6%	0%	2%	2%	2%	1%	2%	1%	3%	1%

FIGURE 3: SKILL LEVEL VS SKILL GAPS FOR WRITING AND BASIC MATHEMATICS

Career Area	Mathematics Skill Level	Mathematics Skill Gap	Writing Skill Level	Writing Skill Gap
Clerical and Administrative	2.25	0.26	3.25	0.38
Customer and Client Support	2.34	0.50	3.15	0.63
Design, Media, and Writing	1.95	0.09	3.97	0.19
Engineering	4.05	-0.12	3.89	0.23
Finance	3.42	-0.08	3.66	0.26
Healthcare	2.58	0.04	3.66	0.12
Hospitality, Food, and Tourism	2.01	0.54	2.45	0.68
Human Resources	2.61	0.06	3.88	0.28
Information Technology	3.41	0.08	3.76	0.43
Management and Operations	3.08	0.01	3.92	0.16
Manufacturing and Production	2.53	0.60	3.03	0.57
Marketing and Public Relations	2.55	0.08	3.69	0.41
Personal Care and Services	1.60	0.41	2.78	0.52
Research, Planning, and Analysis	3.23	0.24	3.87	0.24
Sales	2.47	0.41	3.31	0.55

FIGURE4: BASELINE SKILL GAPS

	All Career Area	Clerical and Administrative	Customer and Client Support	Design, Media, and Writing	Engineering	Finance	Healthcare	Hospitality, Food, and Tourism	Human Resources	Information Technology	Management and Operations	Manufacturing and Production	Marketing and Public Relations	Personal Care and Services	Research, Planning, and Analysis	Sales
Writing	0.45	0.38	0.63	0.19	0.23	0.26	0.12	0.68	0.28	0.43	0.16	0.57	0.41	0.52	0.24	0.55
Customer Service	0.43	0.46	0.28	0.31	0.26	0.53	-0.20	0.38	0.41	0.46	0.27	0.36	0.41	-0.01	0.43	0.33
Supervisory Skills	0.37	0.30	0.26	0.02	0.20	0.42	0.37	0.57	0.14	-0.03	0.16	0.47	0.25	0.47	0.13	0.42
Basic Mathematics	0.30	0.26	0.50	0.09	-0.12	-0.08	0.04	0.54	0.06	0.08	0.01	0.60	0.08	0.41	0.24	0.41
Communication Skills	0.18	0.18	0.12	0.17	0.14	0.15	0.06	0.40	0.06	0.27	0.02	0.38	0.08	0.38	0.12	0.12
Presentation Skills	0.14	0.03	0.07	0.16	0.15	0.14	-0.01	-0.08	0.34	0.24	-0.03	0.07	0.02	-0.03	0.35	-0.34
Project Management	0.12	0.02	-0.02	0.33	0.27	0.10	-0.59	-0.39	0.26	0.36	0.12	-0.11	0.30	-0.28	0.33	0.05
Organizational Skills / Multi-Tasking	0.10	0.15	0.27	0.04	0.07	0.05	-0.05	0.46	0.07	0.00	0.01	0.18	-0.02	0.36	-0.01	0.12
Problem Solving	0.06	0.32	0.36	-0.01	-0.08	0.08	-0.22	0.22	0.10	-0.03	-0.07	0.23	-0.04	-0.07	0.03	0.17
Time Management	0.02	-0.01	0.26	0.09	-0.21	0.06	-0.23	0.12	0.12	-0.13	-0.23	-0.11	-0.04	-0.02	0.05	0.34
Leadership	-0.03	-0.06	-0.21	0.01	0.13	-0.10	-0.34	0.07	-0.39	0.20	-0.25	0.13	-0.14	0.14	0.03	-0.09
Creativity	-0.21	0.00	-0.02	-0.07	-0.57	-0.15	-0.43	0.19	0.05	-0.55	-0.24	-0.23	-0.11	-0.32	-0.41	-0.28
Computer Literacy	-0.22	-0.21	-0.11	-0.65	-0.41	-0.33	-0.15	0.42	-0.36	-0.84	-0.36	0.23	-0.43	0.44	-0.59	0.00
Building Effective Relationships	-0.24	-0.30	-0.19	-0.54	-0.40	-0.19	-0.47	0.06	-0.22	-0.41	-0.20	-0.13	-0.30	0.02	-0.37	-0.14
Analytical Skills	-0.37	-0.20	-0.26	-0.30	-0.72	-0.38	-0.70	-0.02	-0.40	-0.60	-0.48	-0.26	-0.21	-0.01	-0.36	-0.22
Critical Thinking	-0.55	-0.35	-0.45	-0.63	-0.81	-0.62	-0.40	-0.27	-0.63	-0.70	-0.78	-0.48	-0.61	-0.49	-0.64	-0.58

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