

A Two-Axis Framework for Human Skills

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April 2026

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A position paper. Technical paper and full methodology are forthcoming.

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Abstract

Skills frameworks are plural and well-built, but they don't talk to each other easily. This paper proposes a shared reference frame: a two-dimensional map on which any skill from any framework can be located. The two axes are Focus (where the skill is directed - inward at the self, or outward at others, tools, and the world) and Mode (how the skill is enacted - through thinking, or through the body). The axes emerged from analysis of six existing frameworks and were validated across independent datasets and languages. The map is not a replacement for any framework; it is a shared coordinate system that lets conversations proceed across framework boundaries.

The need

The world is rich in skills and competency frameworks. Each has been built to answer a particular question well - what matters in a sector, what a qualification requires, what an occupation demands, or what a training program should develop. Existing national, international, and institutional frameworks all do work that this paper does not attempt to do; instead, this paper describes an attempt to work across them all cohesively and agnostically.

A skill described in an Australian training package and a skill described in [ESCO](#) may or may not be the same skill. A competency in a defence force's role architecture may map

to several things, or to nothing, in a civilian taxonomy. A learning outcome articulated in a higher education program may describe the same underlying capacity as a workplace competency but in unrecognisable language. Bridging these descriptions is slow, expensive, and often done by hand, requiring expert knowledge of both subject areas and the general skills landscape (see [Doherty and Zhang, 2025](#)).

Two common approaches to describing skills at an abstract level already exist; **single-axis orderings** such as hard vs. soft, technical vs. transferable, or cognitive vs. physical, such as the [WEF Global Skills Taxonomy](#), and **multi-axis categorisations** that proliferate into dozens of dimensions, such as the [O*NET Content Model](#). Each does useful work, for example single-axis frames are intuitive and communicate core concepts quickly, which can be particularly useful when working with clients, students, or educators who are not subject-matter experts. Multi-axis frames preserve richness for within-framework use, an important consideration when evaluating workforce requirements or skill development programs. But in most cases these frameworks are not designed to be used as cross-framework reference tools, and comparing them across systems which have been independently developed and designed is complex.

The need addressed here is for a small, structurally validated reference frame that existing frameworks can be positioned within without having to adopt it. Not as a replacement for any framework, but as a shared map that lets conversations proceed across framework boundaries.

The axes

The key finding in this project is that human skills can be understood in two dimensions, allowing us to plot their positions relative to each other on a skills 'map'. Skills plotted towards the poles of either axis align more strongly with that pole, while skills towards the centre require interaction between *Focus*, *Mode*, or both.

The first axis, **Focus**, runs from *inward* to *outward* (or *me* vs. *the world*). An inward skill is directed at the self, regulating our own thinking, attention, physiology, or behaviour. An outward skill is directed at something external to the self - another person, a team, a tool, a material, an environment, or an institution. The second axis, **Mode**, runs from

cognitive to physical (or thinking vs. acting). A cognitive skill is enacted through mental operations such as analysis, interpretation, judgement, or imagination. A physical skill is enacted through the body; movement, procedure, craft, endurance.

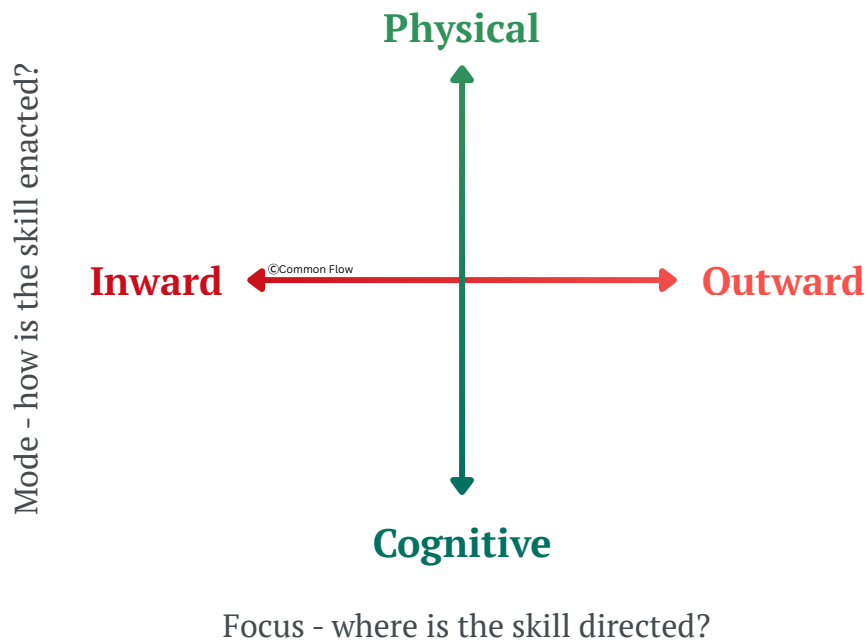


Figure 1. The Two-Axes of Human Skill

Focus describes where a skill is directed; *Mode* describes how it is enacted. Every human skill can be placed on both. The *Inward/Cognitive* region holds skills that work on one's own understanding, such as analysing, perceiving, learning. The *Outward/Cognitive* region holds skills that turn that thinking toward others, including collaborating, coordinating, developing. The *Outward/Physical* region holds skills that act on the world through hands and tools, like executing, tending, ensuring. The *Inward/Physical* region holds skills that draw on sustained attention and bodily steadiness, such as investigating, deciding, enduring.

Skills do not spread uniformly across the plane; they aggregate into recognisable regions. The named clusters of our framework occupy these regions, with their on-plane positions derived from training-corpus centroids with documented corrections.

Our methodology

I used principal-component analysis (PCA) on a set of skills drawn from six existing frameworks. This type of large dataset is complex, so to help us understand how each item relates to each other we use PCA to reduce the number of variables while retaining most of the original information. It's a form of linear algebra to transform the data into 'principal components' or vectors, then looks for the most significant ways that the vectors are different from each other. Sometimes, like in this case, a couple of strong dimensions emerged to explain the differences between the skills in the dataset, and these became our two axes - PC1 **Focus** and PC2 **Mode**.

Why only two? This was the smallest geometry that reproduced what every framework is implicitly distinguishing between. I tested if other axes could provide meaning, and found they either collapsed into a combination of PC1 and PC2, such as Bloom's taxonomy, or failed to change the fundamental nature of the skill and were instead a product of domain or outcome. The axes also bear no relation to any hierarchical structure, and emerge at multiple levels of skill definition. To test the axes and confirm that they were real, and not simply an artefact of the research methods or something specific to the skills taxonomies chosen, a number of methods of independent validation were applied. These were:

Cross-framework replication

The same two leading axes emerge if the PCA is run on just one framework, on a group of frameworks, or on a framework which wasn't used to originally identify the axes (held-out validation).

Linguistic corroboration

The skills from each pole were used to derive names for the axes *after* fitting, and it was found that the axes corroborate with two linguistic signals which had not been provided to the PCA *during* fitting. First, the **subject** the skill is enacted upon predicts the skill's position on the Focus axis - self-directed skills cluster towards the inward pole, while skills that are directed towards other people or things group on the outward pole. Second, the **verb** used to describe the action required by the skill predicts its location on the Mode axis. Verbs like 'analyse' 'interpret' and 'decide' appear at the cognitive end, while active verbs such as 'install' and 'deliver' are found at the physical end.

Checks for possible artefacts from the process or corpus

I wanted to know if the axes had only emerged because of a chosen method or source of data, rather than a property of skills themselves, so I conducted a number of checks, including shuffling the labels 200 times and then recalculating and shuffling words within the labels to remove meaning (which destroyed structure as expected).

Multilingual generalisation

The axes also emerge cleanly if you run the PCA on skills taxonomies independently authored in native languages and not translated from English, specifically, the Japanese Common Skill Framework and the Chilean Catálogo de Competencias Transversales.

I also checked the axes against other ways of understanding diversity in skills, such as Prediger's (1982) dimensions of data/ideas and things/people, which underpin Holland's RIASEC hexagon. Neither of these dimensions align with PC1 Focus, which is the dominant direction of variance we found, although there are similarities between them some of the lower-variance PCs. Prediger and Holland's axes are preferences about objects (vocational interests) rather than modes of agency and scope of action.

Implications and further research

The two-axes framework enables cross-framework translation at scale and depth. We can map skills from one taxonomy, competency standard, job advertisement, occupational classification statement, or common activity to any other via shared coordinates. We can also identify which regions of the map each of these sources covers, and which is silent. The implications for this map at an organisation level include curriculum and workforce design, skills gap analysis, and comparison of qualifications or professional standards across jurisdictions, while at an individual level the map allows people to see which skills their jobs and activities connect to, highlighting strengths and possibilities.

Several extensions could strengthen and stress-test the geometry presented here; broader linguistic and cultural sampling, replication with multiple embedding models, behavioural validation against human raters and established psychometric constructs, temporal robustness across framework vintages, predictive value for labour-market outcomes, and leave-one-out and alternative-method robustness checks.

References

- Boese, R., Lewis, P., Frugoli, P., & Litwin, K. (2001). *Summary of O*NET 4.0 content model and database*. National O*NET Consortium.
https://www.onetcenter.org/dl_files/summary_only.pdf
- Doherty, S., & Zhang, J. (2025). Skills taxonomies in higher education (SSRN Scholarly Paper No. 6185078). Social Science Research Network.
<https://doi.org/10.2139/ssrn.6185078>
- Prediger, D. J. (1982). Dimensions underlying Holland's hexagon: Missing link between interests and occupations? *Journal of Vocational Behavior*, 21(3), 259–287.
[https://doi.org/10.1016/0001-8791\(82\)90036-7](https://doi.org/10.1016/0001-8791(82)90036-7)
- Rivadeneira, E. A. (2017). *Catálogo de competencias transversales para la empleabilidad*. Comisión del Sistema Nacional de Certificación de Competencias Laborales.
<https://chilevalora.gob.cl/wp-content/uploads/2024/12/Catalogo-Competencias-Transversales.pdf>
- Tetzushi, K., Ayako, M., & Shinsaku, M. (2020). Development of the input data for the occupational information network of japan. *Japan Labor Issues*, 4(25), 13–21.
<https://www.jil.go.jp/english/jli/documents/2020/025-03.pdf>
- World Economic Forum. (2021). *Building a common language for skills at work: A global taxonomy*. https://www3.weforum.org/docs/WEF_Skills_Taxonomy_2021.pdf

Artificial Intelligence Disclosure

Anthropic's Claude was used as a cognitive extension during this research, both as a thinking surface for examining ideas and as an assistant for delegated technical work. Specifically, Claude was used to author and run analysis code under my direction, and to provide editorial feedback on prose drafted by myself, particularly the wording of scientific concepts. The identification of the axes (first observed in a UMAP projection and confirmed by PCA), their naming, definition, and the framework's clusters and structure are mine, as is the selection of source frameworks, the comparisons with Bloom's taxonomy and RIASEC, and the authorship of this paper. Claude is not used at inference time in the production pipeline, which is fully local and deterministic.