The Progression of Competencies and Dispositions: How Do Maturing Software Engineers Compare?

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Abstract*— This research paper describes and extends the outcomes from an in- depth study investigating the difference in the expected skills requirements from junior software engineers to senior software engineers, and reflections on the findings from that study. It is a given that senior software engineers have more experience and skills than junior software engineers. However, a focus on their differing competencies and dispositions provides an enhanced mechanism for comparison. Gaps were identified in assessing "professional knowledge" as categorized by the IEEE/ACM Computing Curriculum Overview Report (CC2020), and in assessing "dispositions". It appeared that the specific scenario of comparing the expected competencies between junior and senior software engineers, tested the framework for assessing competencies developed in the CC2020 project and applied in its mapping to the IEEE/ACM Computer Science (CS2013) approved curriculum. In this study into the difference between Junior and Senior Software Engineers, an initial review of relevant literature was conducted. The review found that research analyzing job requirements for software engineers of different levels was limited; "experience" as a keyword was seldom mentioned; and a common distinction was made between "soft" and "hard" skills - the latter being skills that were "technical", such as programming languages, frameworks, libraries, and tools, whereas soft skills referred to skills such as personality traits, attitudes, and teamwork skills. In our extension of that work the notion of soft skills was unpacked into professional skills and dispositions. The process of mapping from the CC2020 competency framework to the CS2013 curriculum had deliberately modelled how to represent a competency-based rather than a knowledge-based curriculum. The critical deficiency identified here was the limitation imposed by adopting a skills framework based on the cognitive taxonomy, and thereby unwittingly omitting the crucial companion aspects addressed within the affective taxonomy. This paper explores that limitation and its implications, by extending the mapping methodology used in CC2020 assessing the development of professional skills and nurturing of dispositions. This methodology was employed to demonstrate how the software engineers moved in competency from junior roles to senior roles. A new approach that marries the cognitive and affective aspects of learning "professional knowledge" and developing "dispositions" for competency-based curricula is presented. An example and a strategy for its extension in assessing the development of software engineers' competencies are provided.

***Keywords*— Competence, Professional Skills, Affective theories**

I. Introduction

In a recent Master's dissertation investigating the difference in the expected "Skills Requirements from Junior Software Developer/Engineer to Senior Software Developer/Engineer [1]; Some interesting and unexpected key insights arose. One aspect of the study was the development of competency statements based on job advertisements. The authors' explore here the findings from that dissertation and the gaps identified in assessing "professional knowledge" and "dispositions" as categorised by the CC2020 Computing Curriculum Overview Report [2].

It appeared that the specific scenario of comparing expected competencies between junior and senior software developers, critically tested the framework for assessing competencies developed in the CC2020 project. The framework was also applied in the mapping to the CS2013 Computer Science curriculum [3]. The process of mapping from the CC2020 competency framework to CS2013, aimed to model how to represent a competency-based rather than a knowledge-based curriculum.

The critical deficiency identified, in the analysis developed here, was the limitation imposed by adopting a skills framework based on the cognitive taxonomy [4], and thereby unwittingly omitting the crucial socio-emotional aspects of learning addressed within the affective taxonomy [5].

In designing the research for this paper the authors explored that deficiency and its implications by applying a research methodology that complemented the CC2020 framework by integrating Blooms affective taxonomy. This study proposes an approach that marries the cognitive and affective aspects of developing "professional knowledge" and nurturing "dispositions". In the case of the latter, a further conjecture is explored namely that an assessment approach based on the observed 'absence' of a disposition may prove to signal a fruitful direction.

Therefore the research questions were:

RQ1 *How do we assess the development of "professional knowledge areas" from junior to senior software developer/engineer, within a competency-based assessment framework?*

RQ2 *How do we assess the nurturing of "dispositions" from junior to senior software developer/engineer, within a competency-based assessment framework?*

II. Methodology

A. Initial study motivating this work

In the study [1] into the difference between Junior and Senior Developers, an initial review of relevant literature using a snowballing technique was conducted. "Snowballing refers to using the reference list of a paper or the citations to the paper to identify additional papers." [6]

The review found that research analysing job requirements for software developers of different levels was limited; "experience" as a keyword was seldom mentioned; and a common distinction was made between and "soft" and "hard" skills - the latter being skills that were "technical, such as programming languages, frameworks, libraries, and tools, whereas soft skills referred to skills such as personality traits, attitudes, and teamwork skills" [1].

Note: The authors themselves are not especially comfortable with the terms "soft" and "hard skills", but they were identified in the study so we report them as such.

Therefore the study sought to contrast how "Skills Requirements" (or we prefer to use the more encompassing terms "capabilities" or "competencies") for practitioners develop in the transition from Junior Software Developer to Senior Developer. The study was based on reviewing job advertisements and contrasting stated junior and senior software developer expectations. Text from one month of job advertisements (November 2022) on SEEK(seek.co.nz) as the most popular job portal in New Zealand was extracted and analysed. The search function enabled the collection of data through searching by job title, with keywords used being "junior software developer" and "senior software developer".

Advertisements usually contained two stated types of job requirement: a skills list and a competency list. A skill list covered the hard skills and soft skills required, whereas a competency list was a list of competency statements that described the expected responsibilities.

B. *Mapping to Competency Statements*

The analysis explored these "competency statements" based on the approach adopted in the CC2020 report and related work [2, 3] where the development of competency statements for computer science had demonstrated a strategy that could be applied to this data and context. See Fig 1.

The concept of a "competency statement" was considered structurally similar to the description of responsibilities and expectations in job advertisements. Furthermore, the CC2020 model has provided a set of vocabularies: a *CC2020 Skill Level Vocabulary* modelled after Bloom's Taxonomy; a *CC2020 Professional and Foundation knowledge Areas vocabulary*; and a *CC2020 Disposition Vocabulary* as tools to break down and assess competency statements [2].

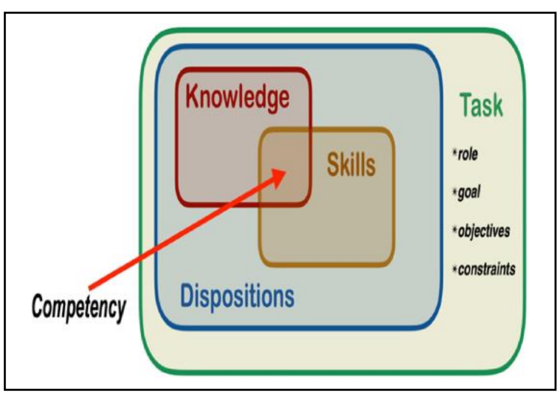

Fig. 1. Conceptual Structure of the CC2020 Competency Model [2].

Applying the process to job advertisement data by fleshing out full competency statements, as adopted in the ITiCSE working report [3], the analysis gave a set of findings as noted in Fig 2. For example these statements were based on the process previously made available through an open repository of the full set of competency specifications and their review spreadsheets at zenodo.com (https://doi.org/10.5281/zenodo.4270438).

C. *Subsequent Synthesis and Conceptualization*

From the analysis, two key insights were derived:

1) for group professional skills such as "teamwork" it proved to be a struggle to map them to the "skills" aspect of the identified competency so they were rated at level 0 of the 'skills' taxonomy;

2) in subsequently allocating dispositions, distinguishing between the "skills" element of the CC2020 competency model and junior and senior expectations of the degree of exhibition of a disposition posed some challenges.

In addressing the challenges a new conceptualization was sought. To extend the model Bloom's affective taxonomy was adopted [5] and applied to enhance the process of understanding the competencies shift required in moving from junior to senior developers.

III. COGNITIVE AND AFFECTIVE TAXONOMIES

In their work on developing educational taxonomies Bloom and colleagues [4] aimed to develop a comprehensive framework in three parts addressing the cognitive, the affective, and the psychomotor domains.

> "The **cognitive domain**. . . includes those objectives which deal with the recall or recognition of knowledge and the development of intellectual abilities and skills. This is the domain . . . in which most of the work in curriculum development has taken place and where the clearest definitions of objectives are to be found phrased as descriptions of student behavior.
>
> A second part of the taxonomy is the **affective domain**. It includes objectives which describe changes in interest, attitudes and values and the development of appreciations and adequate adjustment." [4]

The cognitive taxonomy depicted a hierarchical skills vocabulary classifying levels of learning of cumulatively increasing sophistication where, as noted in the later version,

> "Within the cognitive domain, the six cognitive-learning levels are: knowledge, comprehension, application, analysis, synthesis and evaluation" [7].

It is this cognitive taxonomy that has been adopted as the "skills vocabulary" in the CC2020 report [2].

By contrast the **affective taxonomy** has proved more challenging to apply. For instance the developers of this taxonomy

"For the analysis competency statements, a total of 11 job ads (5 for junior and 6 for senior) were selected, with a total of 57 statements (28 for junior and 29 for senior). Key verbs in the statements were extracted and mapped with CC2020 Skill Level Vocabulary. The six skill levels include Remembering (level 1), Understanding (Level 2), Applying (Level 3),Analysing (Level 4), Evaluating (Level 5) and Creating (Level 6)." [9: 11]

There are a total of 11 dispositions in the CC2020 Disposition Vocabulary, with no hierarchy: Proactive (D-1), Self-Directed (D-2), Passionate (D-3), Purpose-Driven (D-4), Professional (D-5), Responsible (D-6), Adaptive (D-7), Collaborative (D-8), Responsive (D-9), Meticulous (D-10) and Inventive (D-11)...The whole competency statements were evaluated and the most relevant dispositions were assigned to them. The frequency of skill levels and disposition labels were recorded, and also separated into junior and senior. [9:11]

...the most frequently appeared skill levels are level 3(applying) and level 6 (creating); the most frequent for junior job ads is level 3, whereas the most frequent for senior job ads is level 6…The most frequent dispositions are D-8 (collaborative), D-6 (responsible) and D-4 (purpose-driven). Junior job ads focus more on being collaborative, whereas senior job ads also put emphasis on being responsible and purpose-driven on top of being collaborative. Overall, more disposition labels are assigned to competency in senior level job ads than junior level job ads. [9:21]

A noteworthy piece of data is that mentorship appears frequently in senior level job ads, and is exclusive to senior developers. This suggests that mentorship is a desired and distinctive quality of senior software developers compared to junior developers, and is a skill that aspiring senior developers should aim to hone. Communication skill appears in 50% of all job ads, which means it is the most valued quality overall. A possible explanation is that communication skills are not only about teamwork, but can also mean communicating with clients and management, even though the task may be individual. [9:29]

Combining the traditional analysis of hard and soft skills and the mapping of competency statements with skill levels and dispositions, a consistent theme is the frequency of communication and collaboration in job ads. This suggests that software development in companies is not an individualistic job, and it is something that developers need to actively improve. [9:30]

Fig. 2. Contrasting Competencies for Junior and Senior Developers [1]

"...found a great diversity of imprecise affective terminology. Terms such as interest, appreciation, attitudes, and values are commonly used to cover portions of a large range of achievement—from simple awareness to the point of absorption into internal structures guiding behavior. In response, they settled on a single continuum, internalization, as an organizing principle; and were able to construct a hierarchy of five major levels along this continuum.[5]. . . ".

Value Internalization continuum of Bloom's affective domain

Level	Internalization Level Definition	Sub-Level Definition
5.0	Characterization by a value complex	5.1 Characterization
		5.2 Generalized set
4.0	Organization	4.2 Organization of a value system
		4.1 Conceptualization of a value
3.0	Valuing	3.3 Commitment
		3.2 Preference for a value
		3.1 Acceptance of a value
2.0	Responding	2.3 Satisfaction in response
		2.2 Willingness to respond
		2.1 Acquiescence in responding
1.0	Receiving	1.3 Controlled or selected attention
		1.2 Willingness to receive
		1.1. Awareness

Fig 3 Values and their internalization (Based on Krathwohl, Bloom et al).[5].

Progression from Level 1 to Level 5 denotes an increasing level of internalization of interests, attitudes, and/or values. [8]

So this notion of "internalization" is a key distinction to be considered in going beyond the cognitive domain [8]. As an example Fig 3 depicts how these five levels might be considered for the development of a professional outcome such as "being collaborative" or being "pro-active".

IV. DEFICIENCIES IN ASSESSING COMPETENCIES

As noted previously, the study struggled to map the group "professional knowledge area" of "teamwork" and, based solely on its absence from the cognitively derived taxonomy of "skills", had to resort to defining "teamwork" at a default level of 0. While the cognitive taxonomy may be well suited to classifying individual tasks of increasing sophistication, it deals less well with more complex activities and group work. As Bloom has observed:

> "tasks involving synthesis objectives provide a wider kind of experience than those involving mainly acquisition of ideas. Pupils may work as a group. defining important problems. . . proposing hypotheses to account for phenomena, planning simple experiments to test these ideas and actually carrying out the experiments either

individually or in small groups. Such activities should foster productive thinking, some independence in approach as well as cooperativeness". Synthesis objectives occur at most levels of education. Obviously the tasks corresponding to these objectives will differ in their magnitude and complexity from level to level. We would expect a progression from relatively small tasks to much larger tasks as the student moves through the educational program." [4]

Synthesis then, as a cognitive level of learning involves larger tasks, and the expected behaviours of students inherently include more socio-emotional dimensions. Classifying competencies for larger and more collaborative tasks therefore requires a partnership between both the cognitive and affective taxonomies. In the case of classifying "dispositions" such as being "responsible" and "purpose driven", the study found that expectations for senior and junior developers differed. However, in the CC2020 Competency model of Fig 1, the level of a disposition was able to be set only through the skill level assigned at the overall level of the competency statement [2]. So distinguishing a continuum of performance was not considered.

V. APPLYING THE AFFECTIVE TAXONOMY

The affective taxonomy however enables us to address the concerns raised by the first insight and as shown in Fig 4 illustrates how a professional knowledge area can be mapped to one of five levels, rather than resorting to defining "teamwork" at a default level of 0, based on the cognitive taxonomy's CC2020 vocabulary of "skills".

For the second insight then, skills were allocated at the overall level of competency as exhibited in the context of the task. But that single rating failed to represent the continuum of performance that might apply to a specific disposition. For example, how might the levels of expectation differ for being 'collaborative', a disposition required in both the roles of junior and senior developer?

Again the continuum represented in Fig 4 illustrates how being 'collaborative' or "pro-active" other dispositions might also be amenable to mapping in this way. The evolution of this process of internalization, has been operationalised through an "*Example profile of BOK2 outcomes showing suggested affective levels of achievement through formal education*" [8], within a Body of Knowledge for Civil Engineering of selected professional outcomes.

Fig 4 shows the full set of levels of value internalization, with further intermediate stages, drawn from Bloom's Affective Taxonomy [3]. Bloom's work underpins that of Lynch et al [8], who have deemed that the first three levels of: 1) Receiving, 2) Responding, 3) Valuing - were positioned at the undergraduate level of achievement. Level 4) Organizing/conceptualizing – was positioned at the Postgraduate level of achievement, and level 5) Characterizing by a value complex was deemed to apply at the senior professional level beyond the formal education stage of a professional engineer's career. The professional outcome of "Teamwork" as represented in Fig 5 provides one example.

Value Internalization continuum of Bloom's affective domain

Level	Internalization Level Definition	Sub-Level Definition	Disposition Provision of value
5.0	Characterization by a value complex	5.1 Characterization	Promulgates Agile Manifestos
		5.2 Generalized set	Designs Agile standards and frameworks
4.0	Organization	4.2 Organization of a value system	Implements agile frameworks and practices
		4.1 Conceptualization of a value	selects a set of practices for a project/team
3.0	Valuing	3.3 Commitment	Always takes into account deliberately
		3.2 Preference for a value	Prefers to consider in prioritising tasks
		3.1 Acceptance of a value	Recognises client need for value delivery
2.0	Responding	2.3 Satisfaction in response	pleased with reviewer feedback on commits/releases
		2.2 Willingness to respond	willing to incorporate value provision in code
		2.1 Acquiescence in responding	grudgingly tries to take into account
1.0	Receiving	1.3 Controlled or selected attention	inconsistently taken into account
		1.2 Willingness to receive	open to guidance on concept
		1.1. Awareness	has an idea that providing value is relevant
0	Unaware	0.0 Not considered or perceived as relevant	so no value provided

Fig. 4. Internalization of Agile Disposition of "Provision of value"

A. *Augmenting the CC2020 Competency Model*

This work, and as further elaborated below when discussing assessment, shows the potential for the affective taxonomy to complement the CC2020 competency model. The affective taxonomy as depicted in Fig 3 provides a basis for a further socio-emotional vocabulary to be added to the model. The "skills" category in the model of Fig 1 could be refined to include both cognitive and affective dimensions.

A revision of the "Computer Science Competency Statements" designed in the ITiCSE 2020 Working Group Report [3] to incorporate this additional vocabulary would be a productive and concrete direction for further work. This is not to underestimate however, the challenges posed in assessing the socio-emotional aspects of learning. Assessing dispositions can be fraught and open to claims of coercing desired behaviours and passive student acquiescence. Fraudulent imitation of desired outcomes without students having truly internalised the desired values, is clearly not desirable. The next section accordingly, attempts to address how dispositions might be assessed.

VI. ASSESSING AGILITY AS A DISPOSITION

In [9] Clear has argued that "agility" is a disposition, giving an example in the context of agile teamwork. Three key aspects were isolated that might be considered essential for effective agile teams:

"…said to comprise: 1) customer satisfaction, 2) delivery of working software, and 3) provision of value".

So how might the most 'value-driven' dimension of these three elements, namely the notion of "provision of value" itself, be expressed as a disposition? In the case of the project reviewed in [9], it was evident that the team had not internalized the value of the disposition "provision of value" through their work, when they produced inappropriate and irrelevant artifacts, such as 'change management plans' and 'quality assurance plans'. At a stage in the project development when neither the project scope, nor approach to providing a software solution (buy, build or combine - e.g. with open-source components) had been determined, those artifacts really made no sense at that stage.

TEAMWORK	
1	**Receiving**: *describe* characteristics of effective intra- and multidisciplinary teams;
2	**Responding:** *participate* in effective intra- and multidisciplinary teams;
3	**Valuing:** *suggestions* to enhance team performance;
4	**Organizing/Conceptualizing;** *organize* the team including integrating the team members and altering processes to achieve more effective results; and
5	**Characterizing** *displays* team-building skills and *influences* others

Fig. 5. Professional Outcome of Teamwork mapped to five levels of Affective Taxonomy from [8]

As pointed out to the team at their mid-project review, these unnecessary artifacts provided no value for their supervisors, nor for their clients, and therefore through an evident lack of concern for "customer satisfaction" were incompatible with any espoused notion of the team adopting an 'agile' approach. As a result the continuum expressed in figure 3, could be augmented by a further level 0 reflecting the 'absence of a disposition'. The process by which the notion of "provision of value" might be depicted, is portrayed in Fig 4, with the team's initial degree of internalization of the notion assessed as being "unaware" that 'value needed to be provided' by artifacts produced, in order to result in 'customer satisfaction'.

Subsequently the team internalized these key agile values as the project developed. They progressively demonstrated the inherent qualities of a disposition, namely that a disposition concerns "*not what abilities people have, but how people are disposed to use those abilities*" [10], and a disposition therefore requires a degree of judgement, implying *"a tendency or an inclination to act in certain ways as determined to be appropriate in the situation* [11].

The team developed from a perceived compliance mindset to one of seeking out solutions which would provide value to the client. As a result, the team decided on a combined strategy of developing a user interface for the app based on 'React' as a technology, and incorporating a way finding application sourced from a French vendor with whom the team negotiated a trial licence for their prototype application, since they had no budget for the project! Considering this achievement against the continuum in Fig 5, the team can be seen to be operating at a level beyond those of 'receiving' and of 'responding' and mapping to that of 'valuing' the "provision of value "at the level of 'commitment' as the team's actions displayed that "they always took the value into account".

An example of a related strategy to develop the team members' concern for one another, termed "Collective Empathy" [12], has been reinforced through the use of a "Team Contract" whereby the team made explicit the behaviors to be adopted by their members in supporting one another's work, through a 'code of conduct'. The underlying motivation (other than encouraging an agile team mindset and respect for one another within the team) was in supporting a shift from a personal focus from each team member, to an external orientation by delivering functionality addressing customer needs.

As an example, evidencing the team's shift to focusing on 'customer satisfaction', was the provision of a user interface, developed by the team, presented in the several additional languages of the client community (Maori, Samoan, Tongan). Thereby the team leveraged the diversity within their membership and were able to demonstrate collective empathy leading to the extra "provision of value" to their clients!

In reviewing the conduct of the task against the value internalization continuum portrayed in Fig 5, it was clear that different levels of valuing the task were in operation.

However, this scenario neatly illustrates how the **absence of a disposition** is both clearly identifiable and measurable, and the level of its presence can be both identified and the degree to which it has been internalized can be measured by its level in both cases.

In considering the many dimensions of teamwork as illustrated in the work of Tuckman [13] and the well know model of "forming, norming, storming and performing" it is clear that the dimension of conflict within teams is not addressed in Fig 5, but Lynch's depiction [8] is provided here to illustrate how the progression of a disposition or professional competency might be assessed.

VII. Approach for Assessment

Several implications for assessment follow from these insights.

A. *Assessment for a software team's tasks*

In a software team context then, how might this apply for assessing dispositions or professional knowledge? Taking an example of 'team-work' in a software engineering course at author A's institution, as part of their assessment, students complete a team contribution form at the end of a team project. The instructions ask students:

"**As a team** *please come to a consensus on the percentage contribution and participation of each team member. Each team member should sign the form confirming their agreement.*

The default value for assigned % contribution should be 100% for all team members. This corresponds to the situation where all team members contributed and participated fairly evenly.

If a team member contributed less than other team members to the project or was uncooperative or didn't turn up to meetings, then a participation/contribution score of lower than 100% can be assigned to that team member (e.g. 80%) with the others getting 100%, based on what relative contribution you agree on".

Table 1. Team Contribution

Student Team Contribution	
Name	Percentage (%)
Student 1	100%
Student 2	85%
Student 3	85%
Student 4	60%

In the scenario in Table 1 the team contributions have been agreed to be unequal.

So we can relate this to the work of Lynch et al [8] presented through the categorisation in Fig 5, showing how the professional outcome of 'teamwork" might be assessed.

B. *Assessing Teamwork*

In evaluating teamwork contributions, we might assess all the team members from Table 1 to have participated in the team, so they could be said to be operating at least at *level 2: Responding*.

The degree of participation however may differ [as depicted more finely in Fig 5], student 2 and 3 may have demonstrated '*2.2 willingness to participate*' but less arguably '*2.3 satisfaction in participating*'.

Student 4 perhaps could be said to have been operating from Fig 5 at Level '*1: Receiving – able to describe characteristics of effective intra- and multidisciplinary teams*', but more finely from Fig 5 at level '*1.3 showing controlled or selective attention*', or, more generously, at level 2.1 with the level of participation demonstrating '*acquiescence in responding'*.

Student 1 who received 100% could be deemed to have been operating at least at Level '*2.3 satisfaction in participating*', and potentially from Fig 5 at Level '*3. Valuing: share suggestions to enhance team performance*', and at the level of '3.3. *Commitment to sharing'*, (depending on observations of activity, which the authors have seen from some students).

Again student 1 could potentially be operating at higher levels too (depending on further observations of activity and evidenced through mechanisms such as portfolios). As with the scenario of the unaware agile team members, a team member who received 0% would have to be classified as operating at below the Level of that of Fig 5 '*1. Receiving: describe characteristics of effective intra- and multidisciplinary teams*' and below the 1.1 level of Fig 4 '*awareness*'.

So, the absence of an awareness of professional knowledge for a specified outcome, or for a defined disposition, can be said to set a lower bound for assessment, with which levels of internalization can be compared and progressively developed. Thus, mechanisms for assessment do appear to be applicable, and able to be adapted both for assessing the level of internalization of values for professional knowledge and an outcome, and for assessing the level of internalization of values for a defined disposition.

VIII. CONCLUSION

This paper has applied the CC2020 competency model (Fig 1) to assess the differences in performance expected from junior and senior software developers and found that the model can be augmented to more fully assess the affective dimensions of professional knowledge and dispositions. In seeking to understand the implications and the challenges in assessing the socio-emotional aspects of competencies, we have recommended an approach that marries the cognitive and affective aspects of learning "professional knowledge" and developing "dispositions". The affective taxonomy as depicted in Figs 3 & 4 provides a basis for a further socio-emotional "skills" vocabulary based on Bloom's affective taxonomy to be added to the model. Furthermore, it appears that an assessment approach based on the observed 'absence' of a disposition may prove fruitful in setting a baseline for the defined continuum for each professional knowledge area or dispositional component.

Moreover, this approach provides a finer distinction between the cognitive and affective dimensions of both "professional knowledge areas" and "dispositions" as defined in the CC2020 report [2]. This then enables us to move beyond the limited perspective of professional competencies expressed in the pejoratively named set of "soft skills" [14], which has frequently omitted "dispositions", deeming them to be effectively "personal traits" stable over time, and hard to train. Given the growing realisation of the significance of "dispositions" to effective professional performance, their omission is one that we assert is a critical flaw.

A. *Future Work*

Although empirically grounded, the recommendations developed here still represent early conceptual work, with much still to be done to actively embed them in computing curricula and assessments.

However, aspects of practical approaches do exist that could be followed, for instance: [3], [8], [15], [16], [17].

One proposed concrete direction for further work, to provide an example demonstrating the viability of the approach, could include a revision of the "Computer Science Competency Statements" designed in the ITiCSE 2020 Working Group Report [3] to design and incorporate this additional affective "skill" vocabulary.

Conflict in teams is also one topic that needs to be addressed if we are to concentrate more actively on the dispositions needed for effective collaboration and teamwork. More broadly, future work will involve developing these approaches for concrete curricula and assessments, piloting them in real courses and evaluating their efficacy.

The analysis and recommendations presented here have arisen from a concrete and realistic situation, namely that our study had struggled to design competency statements that could distinguish between the levels of performance required of junior and senior software developers. As observed by [1]

> "Industry (often unreasonably) expects graduates to perform competently from the first day they are employed."

In conclusion we believe that we are addressing a real need in defining and assessing maturing competencies for students and practitioners and that the outcomes of the proposed work foreshadowed here has the potential to provide real value for computing educators, students and practitioners.

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