

8 | Exploring adaptive performance of health professions educators with the D-ADAPT-HP

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H.J.M. Pennings¹, L. van Bruggen², K. van den Bosch³, E.A.P.B. Oprins⁴, M. van der Schaaf⁵

ABSTRACT Today's rapidly changing world and complex challenges requires flexibility and adaptability from our professionals. Adaptive performance is relevant for professionals in all kinds of domains, such as engineering, health professions, the military, and education. To study the perceived need for adaptive performance the D-ADAPT questionnaire can be used.

This questionnaire is developed with military professionals in mind. In this book chapter, we describe our efforts to adapt the D-ADAPT questionnaire for use in Health Professions (HP) Education, resulting in the D-ADAPT-HP.

We delineate the steps taken in this process: reformulated some questions, conducted confirmatory factor analysis to study its' suitability for use in HP Education. In addition, we analysed differences in the perceived need for adaptive performance for HP educators' job as a whole and for those who combine tasks areas in their job (i.e., teaching, research, and patient care).

Based on our results we investigated differences between military and HPE and identified the actions to be taken to use D-ADAPT in other contexts like engineering.

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Introduction

Today's rapidly changing world and complex challenges requires flexibility and adaptability from our professionals (Myloupoulos et al., 2018; Pelgrim et al., 2023). There is an increase in studies conducted to get insight in the elements of adaptive performance that professionals in a certain domain need. For example, Oprins et al. (2018) studied adaptive performance in the military context, and Bus et al. (2022) studied adaptive performance of hospital employees during the COVID-19 pandemic. Adaptive performance is relevant for professionals in all kinds of domains, such as professional development for adaptive performance in engineering and education (Martin et al., 2015; Van Tartwijk et al., 2017).

Utrecht University aims to support students to develop adaptive expertise and become adaptive performers, as stated in 'The New Utrecht School' vision (Van Geelen & Milota, 2022; Van der Schaaf, 2022). Yet, we do not know to what extent our own educators in the university hospital are adaptive experts and adaptive performers themselves. To gain insight in their level of adaptive expertise, we studied which types of adaptive performance our health professions (HP) educators recognise and deem important for their own work, especially when combining different tasks

(i.e., teaching, research, and/or clinical work). In this chapter, we describe how we adjusted and applied the Dutch Adaptability Dimensions And Performance Test (D-ADAPT; Oprins et al., 2018) to the context of HP education. The D-ADAPT questionnaire is used to measure professionals' perceptions about the level of adaptive performance that is needed in their job. It is also possible to measure how professionals perceive their own level of adaptive performance. However, the focus of this chapter is on the former. We address the literature on adaptive expertise and adaptive performance, how we applied the D-ADAPT questionnaire for use in a health professions education context, and our efforts to validate this questionnaire for this professional domain. Insights based on this study could be used to apply the D-ADAPT questionnaire to other professional domains, such as engineering.

Adaptive expertise and adaptive performance

To develop expertise in task performance, one needs to develop routines, by deliberately practicing the (part-)tasks involved (Ericsson, 2008), because practice and routines lead to efficiency in task performance (Hatano & Inagaki, 1986). However, this does not necessarily mean that someone who is an expert always performs better than a novice or intermediate expert in all situations. Especially when professionals primarily rely on routines they may perform poorly in new or unexpected situations, because they are unable to adapt. According to Van Tartwijk et al. (2017), relying on routines can be risky, especially when environmental or task factors are prone to change.

Already in 1986, Hatano and Inagaki made a distinction between *routine expertise* and *adaptive expertise*. This distinction has gained more attention in the past decade. The term adaptive expertise is referred to as being able to adapt to new or unexpected situations, which requires creativity, flexibility, problem-solving skills and deep conceptual knowledge about the nature of the task (Bohle-Carbonell et al., 2014; Hatano & Inagaki, 1986). Elaborated conceptual knowledge helps an expert to think beyond routines and generate innovative solutions adapted to what the specific situation calls for.

Many definitions of adaptive expertise and performance can be found in the literature. In this chapter we adopt for adaptive expertise the recently proposed definition of Fluit et al. (2024), which states it concerns the ability to identify new, unexpected and complex situations that demand new ways of acting, yet unknown to the professional, as well as the ability to act accordingly in such situations. We distinguish adaptive expertise from adaptive performance as the counterpart of adaptive expertise that is observable in behaviour. We define adaptive performance therefore as observable behaviours that represent adaptive expertise (Fluit et al. 2024).

Pulakos et al. (2000) identified eight aspects¹ of adaptability as a taxonomy for adaptive (job) performance. These aspects were later used as the basis for the I-ADAPT theory by Ployhart and Bliese (2006). These eight aspects of adaptability are: (1) *Handling emergencies or crisis situations*, (2) *Handling work stress*, (3) *Solving problems creatively*,

(4) *Dealing with uncertain and unpredictable work situations*, (5) *Learning work tasks, technologies, and procedures*, (6) *Demonstrating interpersonal adaptability*, (7) *Demonstrating cultural adaptability*, and (8) *Demonstrating physically oriented adaptability*.

Short descriptions of the adaptability aspects are provided in Table 1 (p122). Both Pulakos et al. (2000) and Ployhart and Bliese (2006) developed their own questionnaire to measure adaptive performance of professionals in complex environments; These are called the Job Adaptability Inventory (JAI) and the individual adaptability measure (I-ADAPT-M), respectively.

Dutch Adaptability Dimensions and Performance Test

To measure the self-assessed needs for adaptive expertise to properly function as a professional, as well as to measure the self-assessed level of adaptive expertise of military professionals, Oprins et al. (2018) developed the Dutch Adaptability Dimensions and Performance Test (D-ADAPT). The D-ADAPT is a revised combination of the Individual Adaptability Measure (I-ADAPT-M; Ployhart & Bliese, 2006) and the Job Adaptability Inventory

¹ Pulakos et al. (2000) refer to these aspects of adaptability as dimensions. As dimensions are statistically difficult to identify, we chose to refer to these dimensions as aspects of adaptability throughout this chapter.

TABLE 1 TAXONOMY AND DESCRIPTIONS OF ADAPTABILITY ASPECTS [ADAPTED FROM PULAKOS ET AL., 2000)].

ADAPTABILITY ASPECT	DEFINITION
Handling emergencies or crisis situations	Involves making (split-second) decisions in response to a life-threatening or dangerous situation, or an emergency, while remaining calm and focused.
Handling work stress	Involves remaining calm and cool while handling difficult situations and a highly demanding workload.
Solving problems creatively	Involves applying unique and innovative solutions to problems and thinking outside of the box, by involving seemingly unrelated information or looking at a wide range of possibilities.
Dealing with uncertain and unpredictable work situations	Involves taking action in situations that are unclear, unexpected, in situations where a total picture or information is missing and therefore might be unpredictable.
Learning work tasks, technologies, and procedures	Involves enthusiasm and action to continuously develop to keep knowledge and skills current. This may involve learning about new technology or procedures.
Demonstrating interpersonal adaptability	Involves keeping an open mind in interaction with others, careful listening, and considering other’s viewpoints.
Demonstrating cultural adaptability	Involves openness to learn about values and customs of other cultures, and the willingness to adjust behaviour accordingly, when necessary.
Demonstrating physically oriented adaptability	Involves adjusting to challenging environmental states (e.g., extreme heat or dirtiness) by pushing oneself physically to complete the necessary task.

(JAI; Pulakos et al., 2000) (Oprins et al., 2018). Originally, the D-ADAPT consisted of the eight aspects of adaptability as proposed by Pulakos et al. (2000). However, during validation, results showed that two of the aspects (i.e., 'Dealing with uncertain or unpredictable work situations' and 'Learning new tasks, technologies, and procedures') showed a bad fit for use in the military population. These aspects were therefore eliminated from the questionnaire. The final version of the D-ADAPT measures six aspects of adaptive performance using 31 items: (1) Handling crisis situations (HCS), (2) Solving difficult problems (SDP), (3) Culturally demanding situations (CDS), (4) Physically demanding circumstances (PDC), (5) Handling work stress (HWS), and (6) Interpersonal interaction (II).

The D-ADAPT can be used in two versions. Note that the items for both versions are the same, only the stem is different. The first version is called the *work-adapt* and can be used to assess professionals' perceptions of the amount of adaptive performance their job requires. The guiding question in this version is "How important do you consider this behaviour for your work?" Respondents then rate the importance of the behaviours for their job on a 5-point Likert Scale (1 = 'Not important' to 5 = 'Very important'). For example, "How important do you consider this behaviour for your work as an engineer: Adapting your plan to solve a problem". The engineers then rate the importance of the behaviour "adapting your plan to solve a problem". In that sense, the work adapt is used to study the necessary behaviours or even competencies for adaptive job performance.

The second version is called the *self-adapt* and can be used to measure respondents' perceptions of their own level of adaptive performance. The guiding question here is "How effective do you consider yourself at performing this behaviours in your work?" In that case respondents rate their competency in terms of their effectiveness on a 5-point Likert Scale (1 = 'Not effective' to 5 = 'Very effective'). For example, "How effective do you consider yourself at performing this behaviour in your work as an engineer: Adapting your plan to solve a problem". The engineers then rate how effective they deem themselves in showing the behaviour "adapting your plan to solve a problem". In that sense, the self-adapt measures professional's self-efficacy in adaptive performance.

We selected the D-ADAPT for our study based on a review study and an analysis of the quality of measurement instruments assessing adaptive expertise and adaptive performance (Hissink et al. 2025). This instrument demonstrates adequate validity, reliability, and fairness in its testing. It is suitable for use with professionals and is also applicable to the target group of future professionals, i.e. students (Hissink et al., under review).

Changes made for use in health professions education

When used in a new context it is important to consider whether the measuring instrument will be fit and valid for that new context (Kane, 2013). The original D-ADAPT was developed to measure adaptive performance of military personnel. Some of the items include military terminology, which may not resonate with professionals from other domains, such as HP educators, the target group of our study.

We therefore made some minor adjustments to the formulation of some items so that the content would fit the target group of HP educators better. As we made some changes to the formulation of items we refer to our version of the D-ADAPT as D-ADAPT for Health Professions (D-ADAPT-HP). These adjustments are the same for both the *work-adapt* and the *self-adapt*, so that both versions can be used. Adjustments to the formulations were mainly made for the items measuring HCS.

For example, instead of using ‘crisis situation’ (D-ADAPT question CRS1) and ‘emergency situation’ (D-ADAPT question CRS2), we used the term ‘unexpected situation’ in both items, HCS6 and HCS7 in the D-ADAPT-HP (see Appendix). We chose to make this adaptation also because in the current definition of adaptive expertise the focus mainly lies on being able to perform in unexpected situations (Fluit et al., 2024); these are not necessarily crisis situations or emergencies. We used “...when a situation escalates” instead of “... when a situation turns dangerous” (D-ADAPT question CRS5); and “...when a situation becomes too dangerous” (D-ADAPT question CRS8) and ‘worsening’ instead of ‘threatening’ in CRS3, HCS8, HCS9, and HCS10 in the D-ADAPT-HP.

Of course, in specific cases situations can become dangerous, think about violence against ambulance personnel or physical exposure to x-ray or infectious diseases (e.g., COVID-19). Yet, in HP education, situations tend not to become dangerous or threatening for the HP educators themselves. Given that our target group was HP educators, we chose to adjust the term dangerous to unexpected.

The present study

Most educators in the Health Professions domain have built a career in patient care before becoming a HP educator (Ten Cate, 2021). A large group of educators still combines their clinical work with teaching, as a second career or secondary or even tertiary job task to clinical and/or research tasks. Teaching is a very complex and demanding task (Cornelius-White, 2007), and HP educators may feel that their teaching activities are undervalued (Van Lankveld et al., 2017). Therefore, in their professional development HP educators may focus more on developing their Health Professions knowledge and skills rather than on developing their teaching skills.

In all their tasks, adaptive performance is essential to the HP-educator. This is reflected in how they feel about the need to be adaptive performers in their *job as a whole*. However, some task areas may require more adaptive performance than others. It is important to explore differences in adaptive performance needed for certain task areas. As HP educators are tasked with stimulating students to develop adaptive performance, they may benefit from insights about the different degrees of adaptive performance needed for different tasks. Further, such insights could provide avenues for specific professional development opportunities for HP educators, as well as for students who are trained to perform these tasks in the future.

Additionally, when a HP educator combines teaching with other medical tasks in his professional job (e.g., patient care and/or research), this sets additional demands on the person’s adaptive qualities. It remains unclear

which demands on adaptive performance are being asked from HP educators and whether these differ between task areas. Knowledge on these demands could provide insight in how HP educators could be supported in developing their own adaptive performance.

The goals of the present study were: (1) to test whether an instrument developed for military personnel could be adapted and applied in the domain of HP educators; (2) to get insight into the demands experienced by HP educators in general, for teaching specifically, and per constituent tasks in case their job consisted of multiple task areas (teaching, research, and patient care). This was measured by means of the *work-adapt* version of the D-ADAPT-HP; and (3) to explore whether the need for adaptive performance in HP education differs from the military domain, for which the D-ADAPT was originally developed. To that end, this study could serve as a first external validation attempt of the D-ADAPT, that could also inform adjustments or application of this questionnaire in other domains, such as engineering.

Method

Design and ethical approval

This study followed a quantitative online survey design. Ethical approval for this study was obtained via the Netherlands Association for Medical Education (NVMO) Ethical Review Board application number 2022.6.6. Informed consent was granted by respondents at the landing page of the online administered questionnaire.

Participants and procedure

The target participants were HP educators if they were registered: (1) as requiring the University Teaching Qualification (UTQ), (2) as having started the UTQ trajectory, or (3) as having finished the UTQ trajectory. HP educators were invited to participate in the study via direct email. The questionnaire was administered on-line using Qualtrics.

Instruments

Adaptive performance

Adaptive performance of HP educators was measured using the work-adapt version of the D-ADAPT-HP. The participants were asked to fill out the D-ADAPT-HP up to four times: First, for their *Job as a whole*, and then up to a maximum of three additional times for each of their constituent task areas: *Teaching*, *Research*, and *Patient care*, depending on the task areas they were responsible for or involved in. We did not administer the Self-ADAPT for this study. First, because we made changes to some of the items and wanted to validate the new version of the work-adapt version first. Second, because we wanted to explore our HP educators' perceptions of the need for being adaptive performers. And finally, as we already asked them to fill out the D-ADAPT-HP multiple times, we did not want to make the questionnaire any longer or confuse them with rating the same items even more.

Some participating HP educators are non-native Dutch speakers. We therefore offered participants the choice completing the questionnaire in English

or in Dutch. The D-ADAPT-HP questionnaire consists of 31 items that measure six aspects of adaptive performance. The items were rated on a 5-point Likert scale (1= “not important:” to 5 = “very important”). Example items per aspect were: (1) HCS: “Monitoring how an emergency situation unfolds in order to adapt your behaviour”; (2) SDP: “analysing an unfamiliar problem”; (3) CDS: “Adjust your goals to accommodate people from a different culture”; (4) PDC: “Recognizing when physical circumstances make your job harder to carry out”; (5) HWS: “Determining why you feel stressed”; and (6) II: “Taking the possible reactions of other into account”. For the full original version of the D-ADAPT see Oprins et al. (2018), the English version of the D-ADAPT-HP can be found in Appendix A.

Analysis

The statistical software JASP (version 0.19.0) was used for all analyses. To test whether the factor structure underlying the data corresponded to the six expected aspects, four Confirmatory Factor Analyses were performed (i.e., one per task area: Job as a whole, Teaching, Research, and Patient care). Cronbach’s alphas were calculated for the final six subscales of the D-ADAPT-HP.

We conducted six one-sample T-tests to study whether the means for the separate tasks differed from the means for *Job as a whole*. We tested these effects using a Bonferroni corrected alpha level of .004 (i.e., to correct for multiple testing against *Job as a whole* and against *Patient care*).

To test whether the perceived need for Adaptive Performance on each aspect differed for HP educators whose job consists of multiple subtasks, we first created groups of participants based on the tasks for which they completed the D-ADAPT-HP. This resulted in the following task groups: *Teaching only*, *Teaching and Research*, *Teaching and Patient Care*, and *Teaching, Research, and Patient care*. We conducted six One-way ANOVAs with each D-ADAPT-HP aspect as independent variable and task-group as grouping variable. We tested these effects against a Bonferroni corrected alpha level of .008, to correct for multiple testing.

Finally, to study the differences between the HP educators’ ratings of adaptive performance for ‘Job as a whole’ and for ‘Teaching’ with the ratings of the military personnel, we conducted 12 independent sample-tests. The effects were tested against a Bonferroni corrected alpha level of .004 to correct for multiple testing. The Means for the military sample were obtained from Oprins et al. (2018; retrieved from p.8, Table 5).

Results

Participants

In total, 119 respondents filled out the questionnaire for their *Job as a whole*. Not all the 119 respondents filled in the questionnaire for the separate task areas: 85 completed the D-ADAPT-HP for *Teaching*, 66 for *Research*, and 38 for *Patient care* (Note that, respondents could fill out the questionnaire multiple times if they had more tasks. Therefore, these numbers cannot be added up).

When looking at the number of D-ADAPT-HP versions completed by the respondents, they could be divided into the following task groups: Teaching only (n=13), Teaching and research (n=34), Teaching and patient care (n=7), and Teaching, research and patient care (n=31); Unfortunately, 34 respondents could not be divided into task groups, because they only filled out the D-ADAPT-HP for *Job as a whole*. These respondents are only included in the analysis for *Job as a whole*.

Quality and reliability of the D-ADAPT-HP

Factor analysis

To test whether the factor structure of the D-ADAPT-HP also distinguished the six aspects of the original D-ADAPT we conducted four Confirmatory Factor Analyses, that is, separate for each task area (Job as a whole, Teaching, Research, and Patient care).

To determine the sample size adequacy, we obtained the Kaiser-Meyer-Olkin Measure of sampling adequacy (KMO). For Job as a whole, Teaching, and Research the sample size was sufficient (all values >.50, respectively), which is sufficient for obtaining a reliable factor structure. For patient care, the number of respondents was small (n=38). The KMO criterion was <.50 for many of the variables.

This is deemed insufficient to obtain a reliable factor structure. Therefore, we will only interpret the factor analysis results for *Job as whole*, *Teaching* and *Research*.

Similar results were found for all three versions. The initial Model fit indices indicated an insufficient model fit for *Job as a whole*, *Research* and *Teaching*: Job as a whole: χ^2 (419) =723,887, $p < .001$, CFI=.890, RMSEA=.078; Teaching: χ^2 (419) =663,165, $p < .001$, CFI=.865, RMSEA=.082; Research: χ^2 (419) =630,059, $p < .001$, CFI=.854, RMSEA=.087. Yet, the factor structure largely corresponded to the original D-ADAPT but three items did not fit the six aspects. The items with the worst fit were: “To develop new ways for cooperation” and “Changing your mind because of other team member’s ideas” of the II aspect. This could be explained by the other items being more about cognitively taking others into account, whereas these two items are more about action and collaboration. The item “Adopt an unusual solution to a problem” of the PSD did not fit within this aspect. We choose to remove these items from the analyses.

Removing these three items from the analysis resulted in the following model fit indices for *Job as a whole* χ^2 (335) =575,038, $p < .001$, CFI=.911, RMSEA=.078, which is good; for *Teaching* this resulted in χ^2 (335) =531,222, $p < .001$, CFI=.885, RMSEA=.083 and for *Research* χ^2 (335) =508,625, $p < .001$, CFI=.876, RMSEA=.088. For *Teaching* and for *Research* the model fit indices show an inconclusive pattern, the Chi-square test and the RMSEA show the model fit is sufficient, the CFI shows the model is insufficient. However, since the number of participants for *Teaching*, *Research*, and *Patient care* are substantially lower, we decided to apply the factor structure with sufficient model fit of *Job as a Whole* to these data. This results in a D-ADAPT-HP version that consisted of six sub-scales with 28 items.

Reliability Analysis

Per subscale of the D-ADAPT-HP and per task the reliability was estimated and presented in Table 1. Note that the number of participants is low, the results should be interpreted with caution. The Cronbach's alpha values for all subscales, except Interpersonal Interaction for *Teaching*, showed moderate to very good reliability. For Interpersonal Interaction in teaching the estimated reliability was .66. This is often deemed insufficient, but since it is above .60, we decided to nevertheless use these results and interpret with caution.

D-ADAPT-HP as a whole

Before looking at the individual aspects of the D-ADAPT-HP we conducted a paired sample T-test to study the differences between the entire D-ADAPT-HP versions of *Job as a whole*, *Teaching*, *Research*, and *Patient care*. The Means and Standard Deviations are provided in Table 1 (Total). The results showed that the D-ADAPT-HP for *Job as a Whole* was scored significantly higher compared to *Teaching* ($t= 4.255$, $p<.001$, $d=.46$) and to *Research* ($t=5.290$, $p<.001$, $d=.65$), and the D-ADAPT-HP for Patient care was rated significantly higher than for *Teaching* ($t=-3.050$, $p=.004$, $d=-.495$) and *Research* ($t=-2.074$, $p=.047$, $d=-.373$). The effects were small to medium. The difference between D-ADAPT-HP for *Patient care* and for *Job as a whole* was not significant ($t= -0.129$, $p=.898$, $d=-.021$).

D-ADAPT-HP aspects in different tasks

Table 1 (p.129) shows the means, standard deviations, and one-sample t-test results for the separate D-ADAPT-HP aspects and for the four

distinguished tasks. The two most important findings were that SDP was rated significantly lower for *Teaching* and significantly higher for *Research* compared to *Job as a whole*. HCS was rated significantly lower for both *Teaching* and *Research* compared to *Job as a whole*. The results for *patient care* never significantly differed from *Job as a whole*. To explore whether adaptative performance was rated differently for *Patient care* compared to *Teaching* and *Research* we conducted six more one-sample T-test with the means for *Patient care* as the reference. The differences between aspects showed a similar pattern, except for PDC. Respondents rated those significantly higher for *Patient care* than for *Teaching* and *Research*.

D-ADAPT-HP aspects when combining multiple tasks

HP educators were divided into groups based on all the tasks for which they filled out the D-ADAPT-HP. Since some HP educators only filled out the D-ADAPT-HP for *Job as a whole*, those could not be placed in either of the task-groups, therefore we proceeded the analysis with the remaining data of 83 HP educators. The results are presented in Table 2 (p.130). With the Bonferroni corrected alpha level, none of the differences were significant.

However, two effects are worthwhile mentioning: the ratings for dealing with CDS and for HCS, which could be interesting for future studies that include more participants combining multiple tasks. It appears that CDS need lower adaptive performance for HP educators who combine *Teaching* with *Patient care* than for HP educators who were in the *Teaching only* or the *Teaching and Research* group. For HCS, the means are pointing towards

TABLE 1 MEANS, STANDARD DEVIATIONS, AND CRONBACH’S ALPHAS FOR THE D-ADAPT-HP SUBSCALES PER TASK

	JOB AS A WHOLE			TEACHING			RESEARCH			PATIENT CARE*		
	M	SD	α	M	SD	α	M	SD	α	M	SD	α
SDP	4.34	0.52	.86	<u>3.70</u>	0.74	.84	<u>4.54</u>	0.46	.78	4.23	0.92	.95
HCS	4.16	0.59	.86	<u>3.91</u>	0.69	.89	<u>3.84</u>	0.74	.89	4.20	1.03	.95
CDS	3.51	0.81	.92	3.50	0.81	.92	<u>3.09</u>	0.93	.92	3.52	1.08	.96
II	3.96	0.55	.71	3.89	0.60	.66	<u>3.55</u>	0.66	.75	3.89	0.89	.91
HWS	3.81	0.70	.91	3.61	0.76	.90	3.64	0.80	.91	3.74	0.95	.94
PDC	2.93	1.21	.97	2.72	1.16	.96	2.70	1.18	.96	3.19	1.28	.98
TOTAL	3.72	.50	.93	3.54	.60	.93	3.53	.56	.92	3.80	.85	.97

NOTE

SDP-Solving Difficult Problems. HCS-Handling Crisis Situations. CDS-Culturally Demanding Situations. II-Interpersonal Interaction. HWS-Handling Work Stress. PDC-Physically Demanding Circumstances.

Aspects that significantly differ from the *Job as a whole* mean are underlined. Aspects that significantly differ from *Patient Care* are presented in bold type face.

TABLE 2 MEANS, STANDARD DEVIATIONS AND ONE-WAY ANOVA RESULTS FOR THE DIFFERENT TASK GROUPS

	T-O		T-R		T-PC*		T-R-PC		ANOVA		
	M	SD	M	SD	M	SD	M	SD	F (df)	p	η ²
SDP	3.85	0.70	3.81	0.63	3.54	0.92	3.57	0.83	.793 (3,79)	.502	.029
HCS	4.00	0.71	4.10	0.59	3.54	0.85	3.75	0.72	2.249 (3,80)	.089	.078
CDS	3.72	0.66	3.62	0.76	2.66	0.90	3.47	0.81	3.330 (3,79)	.024	.112
II	3.91	0.60	4.04	0.64	3.81	0.18	3.72	0.61	1.436 (3,74)	.239	.055
HWS	3.46	0.87	3.66	0.83	3.23	1.08	3.69	0.53	.799 (3,71)	.498	.033
PDC	2.53	1.14	2.74	1.10	1.92	0.74	2.95	1.27	1.452 (3,71)	.235	.058

NOTE

*The number of participants in the Teaching and Patient care group is very low, the results should be interpreted carefully.

T-O Teaching only
T-R Teaching and Research
T-PC Teaching and Patient Care
T-R-PC Teaching, Research, and Patient Care

SDP Solving Difficult Problems
HCS Handling Crisis Situations
CDS Culturally Demanding Situations
II Interpersonal Interaction
HWS Handling Work Stress
PDC Physically Demanding Circumstances

TABLE 3 ONE SAMPLE T-TEST RESULTS BETWEEN HP EDUCATOR SAMPLE AND MILITARY SAMPLE

	D-Adapt Aspect	M	Military reference M	t	df	p
Job as a whole	SDP	4.34	4.05	6.085	118	<.001
	HCS	4.16	3.98	3.229	118	.002
	CDS	3.51	3.54	-.0346	118	.730
	II	3.96	3.82	2.873	118	.005
	HWS	3.81	3.73	0.104	118	.917
	PDC	2.93	3.81	-7.933	118	<.001
Teaching	SDP	3.70	4.05	-4.273	82	<.001
	HCS	3.91	3.98	-0.904	83	.369
	CDS	3.50	3.54	-0.491	82	.625
	II	3.89	3.82	1.010	77	.316
	HWS	3.61	3.73	-2.198	74	.031
	PDC	2.72	3.81	-8.077	74	<.001

NOTE

SDP Solving Difficult Problems
HCS Handling Crisis Situations
CDS Culturally Demanding Situations

II Interpersonal Interaction
HWS Handling Work Stress
PDC Physically Demanding Circumstances

higher ratings for the *Teaching only* and *Teaching and Research* groups compared to the *Teaching and Patient care* and *Teaching, research and patient care* groups.

Adaptive performance HP educators vs. the original military sample

Oprins et al. (2018) developed the D-ADAPT for use in the military context. In their study they also compared their result with those of professionals in other civilian professions. It is interesting to explore whether and to which extent the D-ADAPT-HP scores for *Job as a whole* and *Teaching* of HP educators differ from the D-ADAPT scores obtained in the original study with military personnel². The results are presented in Table 3 (p.131).

The results show that the HP educators in our sample perceive the need for adaptive performance differently compared to respondents from the military sample. PDC was rated significantly lower by HP educators for *Job as a whole* and *Teaching* compared to the military. SDP was rated higher by HP educators for *Job as a whole* and lower for *Teaching* compared to the military sample. HCS was rated higher by HP educators for *Job as a whole* compared to the military sample, for *Teaching* this difference was not significant.

² It should be noted that this was added purely for exploratory purposes, since these target groups are not entirely comparable, and also small differences in the D-ADAPT-HP compared to the D-ADAPT were made.

Discussion

The goals of this study were: (1) To test whether an instrument developed for military personnel could be adapted and applied in the domain of HP educators; (2) To gain insight in how HP educators evaluate the importance of adaptive performance on six adaptivity aspects, for each of their job as a whole, the constituent task areas separately, and for the combined task areas; and (3) to test whether HP educators assess the need for adaptive performance in their work differently than military personnel does.

How adaptive do HP educators need to be?

The results showed that HP educators indeed need to be adaptive performers, but the extent to which they feel they need to be adaptive differs per aspect and per task area. For example, at average adaptive performance for their job as a whole was scored almost equal as adaptive performance to *Patient care*. Lower ratings were given to adaptive performance needed for *Teaching* and *research*. These are average scores per task, implying that not all participants fulfilled all tasks areas, e.g. many of the participants were not involved in patient care. Our findings could possibly be related to the combination of different tasks, which could make the *Job as a whole* more challenging and might increase the perceived need for adaptive performance. It would be interesting to study this further, for example by conducting a qualitative study on how HP educators combine different task areas.

When compared to *Job as a whole*, the ability to solve difficult problems (SDP) was rated as significantly less important for *Teaching* and as

significantly more important for *Research*. This finding is not surprising because when doing research, one is essentially solving a complex problem, and for that adaptive performance is crucial. Yet, one could wonder whether it then still is adaptive performance or whether problem solving is inherent to the job, and therefore has become routine performance? This question could be answered in future research. For example, whether researchers who excel in their academic career develop better adaptive performance, or is adaptive performance a prerequisite to become a good researcher?

When compared to *Job as a whole*, the ability to handle unexpected situations (HCS) was rated as significantly less important for both *Teaching* and *Research*, probably because when combining the task areas requires dealing with tasks that involve a crisis or an unexpected situation more often. When compared to *Job as a whole*, the ability to deal with physically demanding circumstances (PDC) was rated as significantly more important for *Patient care* than for *Teaching* and *Research*. This finding is as expected, since patient care in general entails more physically demanding subtasks (e.g., carrying patients, running around wards, working in bloody surroundings vs. standing or sitting in front of a classroom or at a desk) than teaching or research does.

When looking into the need for adaptive performance when combining multiple task areas, we did not find a lot of differences between the distinguished adaptivity aspects. Only that HP educators who combine *Teaching* with *Patient care* evaluated the ability to be adaptive in culturally demanding situations (CDS) as significantly less important than HP

educators in the *Teaching only* group, or in the *Teaching and Research* group. It could be that participants involved in patient care encounter such situations more often and therefore are more trained to solve those, which could result in a lowered perceived need to be adaptive in such situations.

Finally, since the D-ADAPT was developed for the military context, we considered it interesting to compare our present results with the original military sample (retrieved from Oprins et al., 2018). Results showed that HP educators considered some aspects of adaptive performance as more important for their work than respondents of the military sample did. This suggests that the degree to which adaptive performance in certain aspects is considered important differs between jobs and maybe even between tasks within jobs.

When training students and staff to become adaptive performers, it is therefore advised to carefully analyse what the critical aspects of adaptive performance in a specific profession are, and under what conditions these need to be expressed. For example, for military professionals it may be important to be adaptive in culturally demanding situations (CDS) (e.g., when deployed in a mission in foreign and unfamiliar territory). It may also be important for general practitioners when working in disadvantaged communities. In contrast, being adaptive in culturally demanding situations may be less required for engineers that might work in often well-known and more predictive work environments. Based on this analysis, learning goals regarding adaptive expertise development and adaptive performance could be formulated.

For engineering this could start by analysing the tasks that often require adaptive performance within the domain of engineering, such as solving complex problems. Of course, nuance is needed regarding different areas of engineering. After all, the problems that an aerospace engineer, an electrical or civil engineer comes across, may differ in complexity or urgency. One should keep this in mind when designing education in such different domains.

Suitability of D-ADAPT-HP for HP educators and other domains

When the D-ADAPT is used in a new context, in our case HP education, but also other domains, such as engineering, it is important to build an argument that the results and conclusions obtained with the instrument are valid (Kane, 2013). This includes careful consideration of whether the formulation of items fits with the target group and whether reformulation is needed. In our study we reformulated some items before administering the D-ADAPT questionnaire (See Changes made for use in health professions education in the introduction). For example, changes we made in the formulation of the items measuring Handling Crisis Situations, resulted in the dimension measuring Handling Unexpected Situations. After data collection it is important to assess whether the factor structure underlying the instrument remains intact.

After we removed three items, which were not a good fit with measurement of adaptive performance in HP education, this proved indeed the case in our study. Because we chose to use a previously validated questionnaire and conducted several checks on evidence for validity, we are confident

that the D-ADAPT-HP was suitable for measuring adaptive performance in HP education. Yet, for use in other domains, such as engineering, we first recommend to carefully check the validity for use in a new context (Kane, 2013).

Limitations and future directions

Our study has several limitations. First, the number of participants that fully completed all demanded versions of the questionnaire was relatively low. For example, there was only a small number of participants that filled out the D-ADAPT-HP for patient care, which means that we probably did not reach a sufficient number of participants who combined teaching with patient care. At least not sufficient to gain a reliable result from the factor analysis (i.e., KMO criterion was low). As a result, the groups based on task areas were in some cases too small to draw valid conclusions from. Also, the participant we did reach could be prone to selection bias, those teachers motivated to help us with the study.

Second, we did not directly measure all tasks participants literally and primarily conduct in their daily work. We had to make inferences about their tasks by the number of times they filled out the D-ADAPT-HP for different tasks. In a future study, we would specifically ask which task they have and which task they see as their primary task. However, the findings still provide relevant insights for future research and practice.

Next, in our study we were interested in which aspects of adaptive performance were perceived as important for their job by HP educators.

We did not ask them to reflect on their own adaptive performance as HP educators. Although we had good reasons for not administering the Self-ADAPT in this study (see method section), in future studies, it would be informative to also administer the Self-ADAPT questionnaire in addition to the D-ADAPT(-HP). This is especially relevant, to gain insight in the discrepancy between what is needed and what the current level of adaptive performance of HP educators is.

Further, we made small adaptations to the original questionnaire, as we reformulated the words ‘crisis’ and ‘emergency’ in the items into ‘unexpected’. As this fits with the current definition of Adaptive Performance this in itself is not a limitation. However, this means that the aspect Handling Crisis Situations does now actually measures something different, namely Handling Unexpected Situations. In our manuscript, for the sake of clarity we kept the aspect name Handling Crisis Situations. In future studies we suggest using Handling Unexpected Situations when using the D-ADAPT-HP. Also, this change has implications for the results concerning the comparison with the military sample retrieved from Oprins et al. (2018). These results should therefore be interpreted with care.

We are confident that we were able to use the D-ADAPT successfully in the domain of Health Professions education. A potential shortcoming of the original D-ADAPT (Oprins et al., 2018) is that it excluded two subscales of adaptivity, i.e., measuring the aspects ‘Dealing with uncertain or unpredictable work situations’ and ‘Learning new tasks, technologies, and ‘procedures’. In the original D-ADAPT these were removed due to bad fit of the

data. Yet, the ability to deal with uncertain and unpredictable situations and the ability to learn about new things during professional development are theoretically of central importance when becoming adaptive experts.

Although it may have been opportune to exclude these aspects for practical reasons in the Oprins et al (2018) study, these aspects would potentially have been suitable for inclusion in our present study. As adaptive performance and adaptive expertise may be expressed differently in different contexts, as the results of the comparison of HP educators to military also seem to indicate. Unfortunately, we did not realise this before collecting our data. In future research, it will be interesting to review the relevance of the omitted aspects and investigate the relevance for the professional domain in question.

This may emerge into different versions of the D-ADAPT, with different sets of subscales to be used in different contexts. It should be noted that reinstating the aspect “Dealing with uncertain and unpredictable work situations” will result overlap with the changes made in the HCS aspect in the D-ADAPT-HP. This requires an extensive study within different domains.

Finally, when studying adaptive expertise and adaptive performance in engineering, future research could focus on exploring the need for adaptive expertise in general engineering tasks, and for different types of engineering. This could result in developing an ‘engineering version’ of the D-ADAPT and comparing the results on the work-adapt across different types of engineering (e.g., aerospace, civil, electrical etc.). To identify

learning goals on adaptive performance could serve an educational purpose by describing the required competencies for an engineer in the workplace.

Conclusion

Adaptive expertise and performance are essential for optimal functioning in a complex changing world. We encourage researchers from different domains, such as engineering and engineering education, to study adaptive performance needed in their job context. The D-ADAPT is a promising instrument for this.

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APPENDIX

THE ITEMS OF
THE D-ADAPT-HP
AS ADMINISTERED
IN THIS STUDY

ADAPTABILITY ASPECT	ITEM
Solving Difficult Problems	1 Analysing an unfamiliar problem
	2 Considering a complex problem from multiple perspectives
	3 Adapting your plan to solve a problem
	4 Comparing different solutions to a problem
	5 Adopting an unusual solution for a problem*
Handling Crisis Situations	6 Understanding the unexpected situation in order to make a proper decision
	7 Monitoring how an unexpected situation unfolds in order to adapt your behaviour
	8 Thinking about how to solve a worsening situation
	9 Taking action at the right moment when a situation escalates
	10 Setting new priorities when a situation escalates
Culturally Demanding Situations	11 Being open to how people from a different cultural background behave
	12 Inquiring about rules, values and habits of another culture
	13 Using your knowledge of a culture to interpret the behaviour of people
	14 Considering how to behave in an unfamiliar culture
	15 Adjusting your goals to accommodate people from a different culture
Interpersonal Interaction	16 Observing the behaviour of other people in order to get to know them
	17 Taking the possible reactions of others into account
	18 Developing new ways for cooperation*
	19 Changing your mind through ideas of team members*
	20 Taking the interest of others into account in your decisions
Handling Work Stress	21 Recognizing signs of stress in complicated situations
	22 Determining why you feel stress
	23 Predicting how stress will affect the quality of your work
	24 Thinking about how you can prepare yourself for stress
	25 Choosing between different options for reducing stress
Physically Demanding Situations	26 Acknowledging your limits in physically demanding situations
	27 Thinking about the physical demands when taking up a task
	28 Thinking about how to maintain optimal performance under demanding physical circumstances
	29 Thinking about ways how to persevere under demanding physical circumstances
	30 Adjusting your plan due to expected changes in the physical task environment
	31 Adjusting your plan due to expected changes in the physical task environment

NOTE

* Removed after
confirmatory
factor analysis