Pit Crew Training

An instructional framework for Pit Crew Volunteers.

Safety	Performance	Diagnosis

OVERVIEW

- Pit crew are trained by WARM, the West Australian Racing Museum.
- WARM competes in motor sport circuit racing & performance tuning.
- Each pit crew consists of up to four Pit Crew Volunteers.

What does it mean to be a Pit Crew Volunteer?

Pit Crew Volunteers in WARM have various roles including:

- reliable safety monitor
- decision-maker; tactician or advisor
- assistant (timekeeper, material security, etc.)
- minor diagnostician (routine pressures, fluid levels etc.).

What are the qualities of a Pit Crew Volunteer?

A Pit Crew Volunteer enters a complex and diverse community of practice: training is a shared opportunity to define and explore the qualities of a Pit Crew Volunteer.

These presumed **desirable attributes** of the Pit Crew Volunteer reprise those of Candy, Crebert and O'Leary's "ideal lifelong learner" (1994, pp.43-44):

- curiosity and a critical spirit
- a sense of the interconnectedness of fields
- information literacy (able to create, share and find)
- a sense of personal agency (self-concept and organisation)
- a repertoire of learning skills.

Pit Crew Volunteers - as any candidate for purposeful learning - are assumed to be **intrinsically motivated**. [Collins, Brown & Newman construe voluntariness as sound evidence of intrinsic motivation (in Resnick, 1989, p. 489).]

A readiness to raise concern if in any doubt about a potential safety issue is an **essential characteristic** of a Pit Crew Volunteer (or anyone in a safety-critical environment, really.) If pit crew personnel notice (*see, hear or smell*) something which, in their opinion, is unusual or troubling they must bring attention to this.

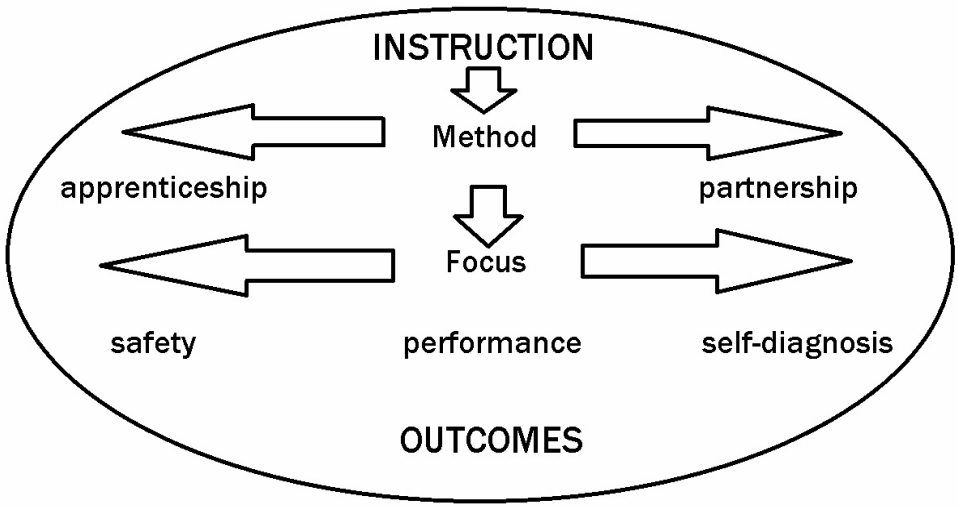
Pit Crew Volunteers are needed as a reliable safety monitor.

Instructional method

Instructional method is aligned to safety, performance and diagnostic outcomes.

Apprenticeship supports safety indoctrination. Further (diagnostic) outcomes are supported through a more exploratory dialogical approach in which selfhood (as an expression of team spirit) is extended. Diagnostic processes (skills) are modelled, scaffolded and coached in Pit Crew Training. The experiences and territory of partnered learning are explored. Visual learning styles and group-based learning aptitudes are rewarded. Assessment is formative and outcomes-directed.

Figure 1 (below) depicts the WARM Pit Crew Training Model:



Assessment

Safety-critical **assessment** within WARM's Pit Crew Training borrows the intent and nomenclature of CBT (that is, competency based training) systems wherein …

> … the only way in which a CBT course can be described is in terms of outcomes ('students will be able to ….') … it is vital that teachers and trainers get assessment procedures right. By passing students as competent, they are … certifying that the students can do whatever the outcome is.
>
> This is a big responsibility … particularly when there are safety implications.
>
> (Smith & Keating, 1997, p. 152)

Assessment is formative only; criterion-referenced; and conducted using checklists.

"Good practice" instructional design priorities replicate those of aviation (as supplied by Gibbons, O'Neil & Fairweather in Hunt, 1997, p.32):

- ensure learning is complete, correct & free of gaps
- reduce time required to learn
- influence long-term retention of learning
- increase likelihood of future learning
- support learning in form readily usable by learner

WARM's Pit Crew Training adopts an **evidence-based approach** in both assessment and design. Thus, the reader is invited to a brief literature review (pp. 8-10) which precedes an instructional rationale (pp. 11-13) and critical reflection (pp. 14-18).

LITERATURE REVIEW

Themes

Three topics - - cognitive apprenticeship; an apparently reductionist-holistic tension in the conception of competency, and the efficacy of group based learning - - are discerned as relevant themes in the literature reviewed.

'Cognitive apprenticeship' establishes a hierarchical, functionally contextualised learning environment. Collins, Brown and Newman (in Resnick, 1989, pp. 453-454) describe it like this:

> … [S]kills and knowledge have become abstracted from their uses in the world. In apprenticeship learning … target skills are not only continually in use, but are instrumental to the accomplishment of meaningful tasks.
>
> Said differently, apprenticeship embeds the learning of skills and knowledge in their social and functional context .

Situatedness - the social and functional contextualization of skills and knowledge - is prized within cognitive apprenticeship. As a community (or allegiance) of practice, WARM is able to provide the boundaries and scope of "functional contextualization".

Gibbons, O'Neil and Fairweather (in Hunt, 1997, p. 33) describe the key attributes of cognitive apprenticeship as follows:

- observation of models by the learner
- coaching & scaffolding of practice which fades over time
- student articulation of knowledge gained through problem-solving
- reflection to encourage integration of knowledge & increased self-assessment
- & some degree of exploration & experimentation.

Cognitive apprenticeship is an allegiance of practice accessed through social (and socially sanctioned) learning:

> … the best way to prepare people for occupations …and more generally for successful life, is through some form of apprenticeship -- an educational process in which the exercise of judgement and the ability to act in the world emerge out of the complex of interactions … a result of social rather than individual activities.
>
> (Gonczi in Foley, 2004, p. 21).

Some perceive a reductionist tendency as *inherent* to competency or vocational training (see, for example, Ashcroft & Foreman-Peck, 1994, pp. 27-28). However, Gonczi (in Foley, 1994) disclaims this tension, instead positing competency as a combination of knowledge, skills and values ("KSVs"). WARM's Pit Crew Training supports a criterion-referenced "KSV-approach" to competency.

The **efficacy of group based learning** is also enacted through WARM Pit Crew Training. This is supported by Tribe who says research findings are "generally" (her word) favourable towards group learning. She says:

> …the achievements of students who work in cooperative settings is superior to those working in competitive and individualistic settings. …
>
> …The interaction variables that have been shown to be the most effective in developing learning among group members are those of giving and receiving help both of which show a positive relation to achievement. …
>
> Students who give help by explaining difficult subject matter to their peers learn more than those who do not.
>
> (Diana Tribe in Thorley & Gregory, 1994, p. 26)

Opportunities for partnered learning activities are coveted within the Pit Crew Training because they provide an opportunity to take advantage of interaction variables. A high level of regard for group-based learning is reflected here in both an instructional model (p. 5) and rationale (pp. 11-13).

INSTRUCTIONAL RATIONALE

… safety, alignment, transfer …

Curricular structure conveys a **"Safety first"** message. Learners construct receipt of the safety message from both its form and content.

The **alignment**, here is conceptual: Realisation of a learning environment in which learning intent, activities and outcomes are concordant with each other, the learners' role, and learning preferences. When diagnostic or performance outcomes are sought, the instructional method shifts to something more like a modest kind of design partnership by which these outcomes are "handled" …

> Handling involves all conditions found in driving - acceleration, straight-line driving, braking and cornering on good surfaces and bad. The good-handling car will be controllable and predictable in all these conditions, and it will provide some degree of riding comfort. … Always keep in mind the use of the car, and work for best handling in that type of driving.
>
> …
>
> The results you get are worth whatever effort you can put into testing. If you are serious about getting the best possible handling from your car, track testing is the only way. In all types of motor racing, you will find those who win the races are the ones who do the most testing.
>
> (Puhn, 1976 p. 3 & p. 93)

In an effective testing scenario the Pit Crew Volunteer is second-to-none: temperatures, pressures and fluid level measurements (and many other measurements and adjustments besides) have great worth. Required here is reasonable control and recognition of variables. A methodical approach is laudable and yields superior results. This is true of any testing scenario.

Training mitigates a third area of concern: **transfer.** Competency training is liable to specify behavioural tasks. This is laudable if the task is safety-critical and the aim of such specificity is to habituate a seemingly automatic response which can be relied on in an emergency.

With safety assured, diagnosis turns from preventative strategies to solution:

> … The problems and their solutions are common to both racing cars and road cars alike, even though they may appear to be quite different. The fact that all cars run on the road and run on rubber tires makes them very similar in the handling department.
>
> (Puhn, 1976. p. 9)

Diagnostic activities also mean that Pit Crew Volunteers become familiar with a troubleshooting method - replete with useful advice (such as "change only one variable at a time") – which can be readily transferred to other domains. [That is, learning how to learn supports transfer. (Knowles, Holton & Swanson, 1998, p.169)]

For discussion

Tribe (*ibid.*) remarks on the transferability of group-work.

Discussion is particularly dynamic as an evaluative device. It needs enthusiasm and structure to encourage, support and sustain it, together with sufficient curricular adaptability to justify it. Given this, it can yield remarkable benefits.

On reflection, helpful discussion has been an early feature of Pit Crew Training.

CRITICAL REFLECTION

The method of evaluation is less important than the motivation to do it …

(Ramsden in Cox, 1994, p. 108)

Is this enjoyable? Interesting? What worked? What didn't? Why?

Pre-session

Peer evaluation has been a useful and continuing resource during creation of this training document. As with Cox (1994, p. 120) it has been found that peers are more interested in outcomes (safety, in particular) than processes of teaching.

Also recognised are roles which can be fulfilled by the peer-evaluator as commentator, critical friend or self-evaluative foil.

Peer evaluation of the Pit Crew Training (prior to its enactment) lead to:

- further consideration, construction & description of pit crew tasks
- greater prioritisation of safety & training safety with visual cues
- changes to the staging of the training schedule (eg. "housekeeping")

Post-session

A one-hour instructional session was conducted at the WARM Museum (see p. 19) of which the final twenty minutes was dedicated to evaluative discussion. Evaluation was driven by Ramsden's underpinning evaluative sentiment and the generic questions which preface this section.

Initial and ongoing evaluative intent is directed towards the level of learners engagement and perceived challenge. These were deemed to be better than satisfactory. The visual imagery and modelling, setting, text and delivery were appreciated.

The sense of physical immersion in the learning environment is praised. It is considered beneficial to have dynamic examples of instructional topics (such as installed isolator switches) on location.

There was cautious interest in the dialogic or partnered learning by volunteers. Likely cautious because it is counterintuitive to learners' individualistic or competitive notions of what a learning environment should be like. Learners may perceive that the pit crew *category* is an essentially objective (not constructed) one.

Pit Crew Training requires judicious scaffolding. Safety concerns mean that instructional design can be neither unequivocally negotiable nor totally inflexible.

Overall, it was felt that the session was successful. Its conclusion was also intriguing and some commentary on this (pp. 17-18) serves as a welcome conclusion.

Continued professional learning

Syllabus is extended and instruction refined through activities which:

- formalise evaluative method through modelling and trial
- provide an inventory of relevant "KSVs" in Pit Crew Training
- nominate criterion for instructional evaluation / self-diagnosis
- revise instructional design priorities (as seen previously, p. 7)
- continue review of peer-referenced literature; and discussion
- allow group-based curricular exchange and negotiation
- re-contextualise items within and beyond domains

Conclusion

An example of partnered learning, it is noted (quite by chance) that the Pit Crew Volunteer was rather struck with the WARM laptop's desktop as depicted below:

CALAMITOUS ...A brave official (above left) looks at the isolator switch to stop the fuel pump as the first of the WARM Pit Crew Volunteers rushes in with fire extinguisher. Catastrophe averted.

A rare race machine was saved, nearby spectators were merely entertained (or shocked); the driver (not pictured) suffered a non-threatening, localised burn only.

Again, this reiterates the ways in which coperative learning is powerful. And visual.

As the background of this image is discussed it captures the relevance and value of safety outcomes and pit crew training within motor sport. It will probably be included as a compelling and evocative introductory image in future instruction as both an example of safety and fortuitous meta-design (in-partnership.)

An implicit appeal to a visual learner style (and viewing ease) is considered appropriate. Visual cues are prevalent within motor sport for safety reasons.

This Pit Crew Training document is also found to usefully codify certain aspects of volunteers' duties, particularly with regard to desirable, assumed and essential learner attributes (see Overview, pp. 4-5).

Individual learners are adept at recognising what works or does not. A strength of group based learning is found with its ambitious capacity to identify what can be improved and together lending inspiration to that ambition and sharing its success.

LESSON PLAN & SAMPLE MATERIALS

Equipped for one-to-one instruction, the WARM Museum (located about 20 minutes south of Perth CBD, Western Australia) frames WARM's activities and contextualises learning.

Planned (as below); a one hour session was conducted for a Pit Crew Volunteer.

Title	Pit Crew Training LP 1
Topic(s)	Overview / Safety / Handling
Assessment	Safety checklist 1
	Handling checklist 1
Date / Time	18 June 2015 / 1700-1800
Location	WARM Museum
Context	first session
Learner profile	novice adult
Materials	laptop, text
Text	F. Puhn. How to make your car handle.
	WARM Pit Crew Training Document

1800-1820 PRE-INSTRUCTION

Housekeeping	(muster point, facilities, etc.)
Visual overview	(Pit Crew Training Models)
Meet and greet	(WARM Director, Mr. Neil McCrudden)

1820-1840 INSTRUCTION

Safety checklist 1 .....

Safety checklist 2 .....

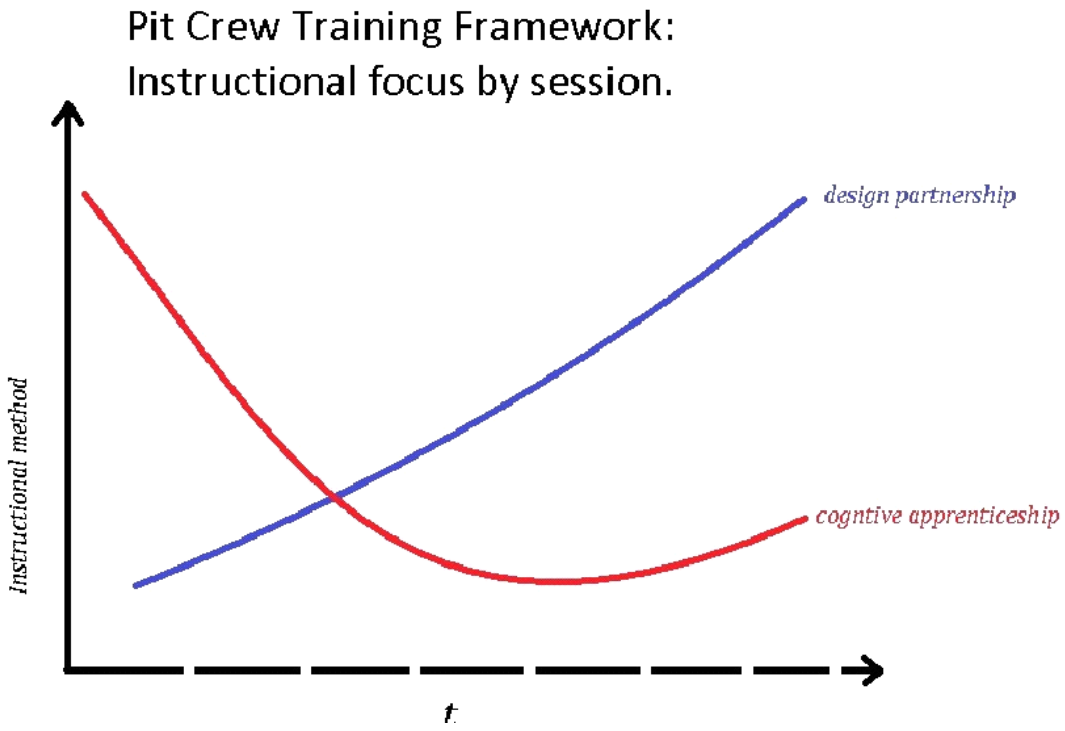
1840-1900 EVALUATION

Discussion / Feedback

engagement? level of challenge? what worked? what didn't?

WARM Pit Crew Training Models: Figure 1 (p. 6) and Figure 2 (below).

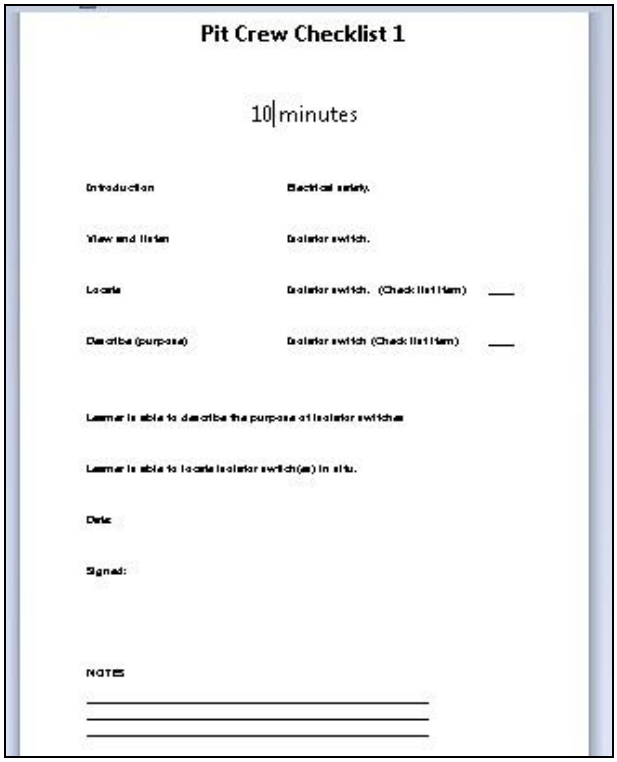
Fig. 2



Look for the blue triangle!

The isolator switch is critical to safety.

Checklists (as below) are used as formative assessment of instructional outcomes.



Pit Crew Checklist 1

10 minutes

Introduction	Electrical safety.
View and listen	Isolator switch.
Locate	Isolator switch. (Checklist item) ___
Describe (purpose)	Isolator switch (Checklist item) ___

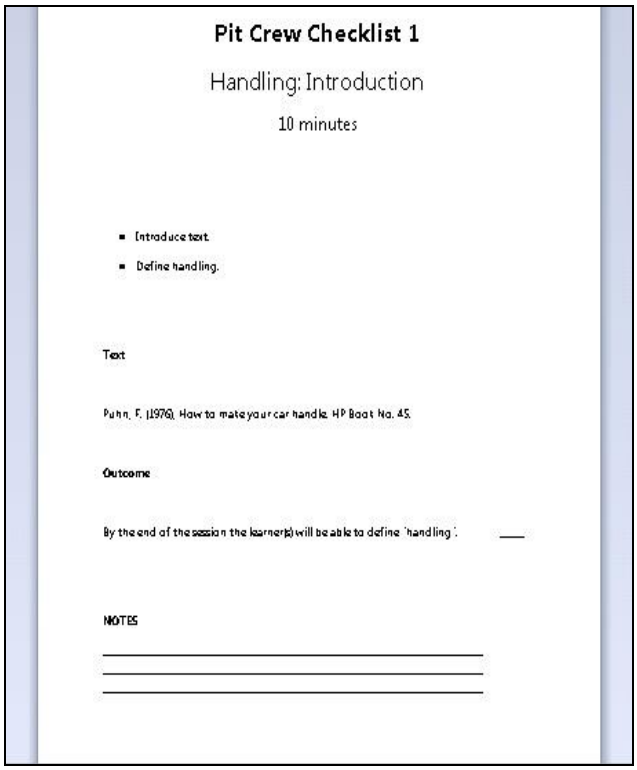
Learner is able to describe the purpose of isolator switches

Learner is able to locate isolator switch(es) in situ.

Date:

Signed:

NOTES



Pit Crew Checklist 1

Handling: Introduction

10 minutes

- Introduce text.
- Define handling.

Text

Puhn, F. (1976). How to make your car handle. HP Book No. 45.

Outcome

By the end of the session the learner(s) will be able to define 'handling'. ___

NOTES

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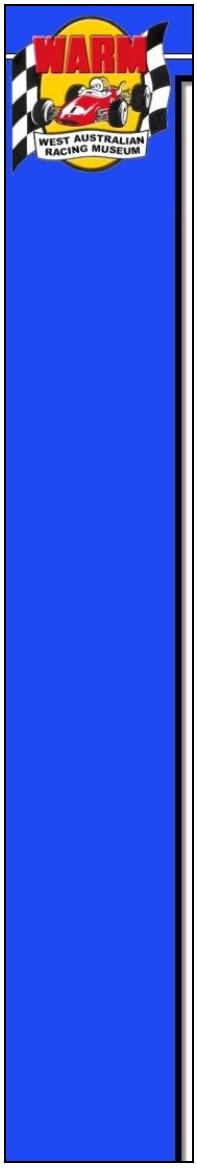

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