

Article

Enhancing Higher-Order Skills Education and Assessment in a Graduated Motorcycle Licensing System

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Abstract: Prior to 2016, motorcycle licensing in Victoria, Australia, required off-road (range) skills testing only, focusing on vehicle-handling skills. The objective of this research was to develop an education and assessment curriculum commensurate with best practice that included on-road components and increased focus on awareness, judgment, and decision-making skills. No single best-practice curriculum was identified in the published literature. Therefore, to guide development of a new curriculum, a best-practice novice driver education framework, Goals for Driver Education, was adapted into the Goals for Rider Education framework. Applying Training Needs Analysis, the target population of learner motorcyclists was identified as largely male and aged under 30 years, with the target crash problem including a high proportion of single-vehicle loss-of-control crashes. Tailored content was developed based on exemplary Australian and international curricula, behaviour change theory, and adult learning principles; including transitioning from training to coaching and from testing to competency-based assessment. The result is Victoria's new Motorcycle Graduated Licensing System (M-GLS) education and assessment curriculum, comprising three stages: pre-learner (Motorcycle Permit Assessment), learner (Check Ride), and pre-licence (Motorcycle Licence Assessment). Subject to potential refinements and on-going evaluation, this work lays the foundation for establishing a best-practice approach to novice motorcyclist education for licensure.

Keywords: motorcycle; powered-two-wheeler; graduated licensing; education; training; coaching; testing; competency-based assessment; crashes

1. Introduction

Australia has experienced an escalation in motorcycling popularity over recent years. The increase in registrations of powered-two-wheel vehicles is higher than for any other vehicle type, increasing by 22.3% compared to an overall vehicle increase of 12.1% over the last five years to 2015 [1]. However, unlike for passenger car occupants, who have experienced annual decreases in crash fatalities, motorcyclist fatalities have either shown increases or remained steady [2]. Overall, motorcycles represent only 4.5% of the Australian vehicle fleet [1], but motorcyclists represent 17.9% of all road fatalities [2]. This has led to revised motorcycle safety strategies at a national [3] and state level (e.g., New South Wales [4]).

Most Australian states and territories require motorcyclists to be licensed first on a learner permit with some restrictions prior to full licensure (including limits on engine size and carriage of pillion passengers; helmets are mandatory for all riders) [5]. To qualify for the learner permit, applicants must either undergo mandatory training and/or off-road (on-range) practical skills testing. In the state of Victoria only on-range skills testing has been mandatory for several decades.

In 2010, the Victorian state government road authority, VicRoads, released a discussion paper identifying an over-representation of learner motorcyclists in their crash statistics [6]. The rate (per 100,000 licences) of killed and seriously injured learner riders was almost three times that of licensed riders (697.4 versus 235.1); commensurate with other Australian and international research identifying inexperience as a leading factor in motorcyclist crash fatalities [7–9]. This was followed by a series of community consultation sessions in 2011 to obtain the views of stakeholders on how to address this. The consultation process revealed strong support for improvements to the training curriculum for novice motorcyclists, with an earlier review identifying an over-reliance on the training of vehicle-handling skills compared to attitudinal skills [10]. Through a series of tenders in 2014, the development of a three-stage mandatory education and assessment curriculum was commissioned, with all stages required to include on-road in addition to on-range practical components, with an increased focus on awareness, judgment, and decision making. The three stages comprised:

1. Pre-learner stage: a course incorporating all key requirements for obtaining a Victorian motorcycle learner permit—the Motorcycle Permit Assessment.
2. Learner stage: a coaching opportunity and progress check on initial riding on the learner permit—Check Ride.
3. Pre-licence stage: an individual coaching and assessment session to transition to a Victorian motorcycle licence—the Motorcycle Licence Assessment.

The objective of this research was to develop the three-stage education and assessment curriculum for Victoria's new Motorcycle Graduated Licensing System (M-GLS) commensurate with best practice. The purpose of this paper is to document the development methods and features of the resulting curriculum.

2. Methods

To identify a model curriculum framework for novice motorcyclist education, a search of peer-reviewed literature was conducted in June 2014 using Scopus, supplemented with targeted searches of grey literature and training models in Australia, as well as exemplar models in Europe, North America, and Asia. Searches focused on combinations of the terms “pre-learner” OR “learner” OR “novice” OR “beginning” OR “beginner” with “motorcyclist” OR “motorcycle” OR “rider”.

In the absence of a single exemplar model that met the project requirements, a guiding framework was developed, adapted from a best-practice framework applied in novice driver education, and a Training Needs Analysis was conducted, comprising the following sub-activities:

- (a) Define the target rider population, i.e., those individuals who will undertake the curriculum.
- (b) Specify the tasks that graduates should be able to perform.
- (c) Specify the knowledge, skills, and attitudes required for safe and effective task performance.
- (d) Specify the knowledge, skills, and attitudes to be learned through the curriculum and relevant principles of learning.

For step (a), the age, gender, and prior driver licensure of new learner motorcyclists at the time of the study was examined in VicRoads Driver Licensing System data records for 1 January 2014 to 30 June 2014. Equivalent information of learner motorcyclists involved in crashes was identified from the VicRoads police-recorded crash database for the five years from 1 January 2009–31 December 2013. For steps (b) to (d), the content, teaching approaches, and assessment needs were determined from exemplar models identified from the literature review and supplementary literature on behaviour change theory and adult learning principles.

3. Results

3.1. Guiding Framework

Of a total of 177 unique records identified in Scopus, 62 were related to novice motorcyclists. This included a 2010 Cochrane systematic review of evaluation literature on the effectiveness of rider training programs [11], with no later evaluations identified in Scopus or the grey literature.

The Cochrane review included six evaluations specific to the pre-learner phase. Of three cohort studies, two randomised control trials (RCTs) and one case-control study, only one RCT found statistically significant differences. Crash reductions were found at six months, one year, and two years post-training. However, offence increases also were found, but only at the one-year follow-up. This highlighted a concern, known from novice driver curricula evaluations [12], that such curricula risk increasing perceptions of competence to a higher level than actual (miscalibration), and as such can lead to increased risky behaviour and crash involvement. Given that the program evaluated in the RCT was discontinued and was a more specialised vocational program focusing on scooter riders delivering mail, it was not pursued further. Notably, the Cochrane review authors also concluded that many of the studies reviewed had inherent methodological weaknesses and that, overall, the literature was inconclusive as to the value of motorcyclist education [11].

In the absence of a guiding framework identifiable as best practice for novice motorcyclist education, a best-practice framework previously applied for novice driver education [13] that included the desired focus on awareness, judgment, and decision making was explored: the Finnish Goals for Driver Education (GDE) model [14]. The GDE framework identifies specific knowledge and skills, risk-increasing factors, and self-evaluation needs at four hierarchical levels, increasing in focus from physical to cognitive to attitudinal skills: (I) basic vehicle control (operational level); (II) mastery of traffic situations (tactical level); (III) trip-related context and considerations (strategic level); and (IV) personal characteristics, ambitions, and competencies (general level). By substituting driver-specific terms applied in a novice driver GDE model [13] to those relevant for motorcyclists (such as “car” to “vehicle”, “driving” to “riding” and “seatbelts” to “personal protective equipment”), we identified that the GDE framework was applicable for addressing the higher-order skills required for the new M-GLS curriculum. The resulting Goals for Rider Education framework is presented in Table 1.

Much of the two lowest levels (rows) of Table 1, regarding tactical and operational control, reflected typical content of most of the motorcyclist curricula reviewed, although the last column on self-evaluation skills was sometimes minimal. The next highest level was more inconsistently applied, but it was the highest level that was most often missing or under-developed. This level involves self-reflection, monitoring, and evaluation of how driving/riding is situated within wider personal motives and goals for life and day-to-day living.

It could be argued that the lowest level of the hierarchy plays a more crucial role in the safety of novice motorcyclists than novice drivers, given the greater occupant protection offered by passenger cars. The author of the original proposed hierarchical approach also argued that, while the higher levels always affect behaviour on the lower levels, the lower levels can also affect the higher ones, with success as well as failure on the higher levels affecting demands on the lower levels (cited in [15]). Therefore, attention to all levels was deemed important.

Table 1. Goals for Rider Education framework (adaptation of the CIECA GDE Matrix [13]).

	Essential Elements of Motorcycle Rider Education		
	Knowledge and Skills	Risk-Increasing Factors	Self-Evaluation
Hierarchical levels of rider behaviour	IV. Personal characteristics, ambitions, and competencies (General level) Knowledge and control of general ambitions in life, values and norms, and personal tendencies that affect driving behaviour <ul style="list-style-type: none"> ● lifestyle ● peer group norms ● motives in life ● self-control and other characteristics ● personal values and norms ● etc. 	Risky tendencies <ul style="list-style-type: none"> ● acceptance of risk ● self-value through riding ● sensation-seeking ● adapting to social pressure ● use of alcohol and drugs ● attitude towards society ● etc. 	Self-awareness regarding: <ul style="list-style-type: none"> ● impulse control ● risky tendencies ● personal unsafe motives ● personal risky characteristics ● etc.
	III. Trip-related context and considerations (Strategic level) Knowledge and skills regarding: <ul style="list-style-type: none"> ● choice of route ● estimated riding time ● effects of social pressure from pillion/co-riders ● estimating urgency of the trip ● etc. 	Risks relating to: <ul style="list-style-type: none"> ● physiological condition of rider ● road environment (urban/rural) ● social context and company of pillion/co-riders ● other motives (e.g., competition in traffic) ● etc. 	Self-awareness regarding: <ul style="list-style-type: none"> ● personal skills with regard to planning ● typically risky motives when riding ● etc.
	II. Mastery of traffic situations (Tactical level) Knowledge and skills regarding: <ul style="list-style-type: none"> ● traffic rules ● observation and use of signals ● anticipation ● speed adaptation ● communication ● safety margins ● etc. 	Risks caused by: <ul style="list-style-type: none"> ● poor decision-making ● risky riding style (e.g., aggressive) ● excessive speed ● vulnerable road users ● breaking traffic rules/unpredictable behaviour ● information overload ● difficult (road) conditions (e.g., darkness, bad weather) ● insufficient automation of basic skills ● etc. 	Self-awareness regarding: <ul style="list-style-type: none"> ● strengths and weaknesses regarding riding skills in traffic ● personal riding style ● personal safety margins ● strengths and weaknesses in dangerous situations ● realistic assessment of own skill ● etc.
	I. Basic vehicle control (Operational level) Knowledge and skills regarding: <ul style="list-style-type: none"> ● control of direction and position of vehicle ● surface grip, tyre pressure ● dimensions of vehicle ● technical aspects of vehicle 	Risks related to: <ul style="list-style-type: none"> ● insufficient automation of basic skills ● difficult (road) conditions (e.g., darkness, bad weather) ● improper use of personal protective equipment sitting position ● etc. 	Self-awareness concerning <ul style="list-style-type: none"> ● strengths and weaknesses of basic vehicle control ● strengths and weaknesses manoeuvring in dangerous situations ● realistic assessment of own skill ● etc.

3.2. Target Population and Crashes

Following the first step of the Training Needs Analysis, the target population for the M-GLS curriculum and their most common serious crashes were examined; noting that the minimum age to hold a motorcycle learner permit in Victoria was 18 years.

During the study period, 8543 riders were issued a motorcycle learner permit in Victoria. The majority (83%) was male, with an average age of 26 years (median 30 years). By age groupings, 20% were aged 18–20 years, 41% were aged 21–29 years, 19% aged 30–39 years, 12% aged 40–49 years, and 8% aged 50 years or more. Most of these riders already held a car driver licence: 68% held a full driver licence, 24% held a probationary driver licence, 8% held a driver learner permit, and less than 1% did not have any driver permit or licence.

A total of 818 learner riders were involved in crashes during the study period, including 3% in fatal crashes, 52% serious injury crashes, and 45% other injury crashes. Most involved male riders (83%). Age was categorised into three previously identified crash risk groups [7,8]. As shown in Table 2, a little over half of the learners involved in crashes was aged 25 years or younger, with nearly one-third in the middle age group 26–39, and a small percentage aged 40 or older (including seven aged 60+). A similar distribution by age was found for the male learners involved in crashes, whereas for females the age groups were more evenly represented.

Table 2. Gender and age distribution of Learner motorcyclists in crashes in Victoria (2009–2013).

Age group	Total	Male	Female
≤25 years	52%	56%	38%
26–39 years	32%	32%	32%
40+ years	15%	12%	30%

Table 3 lists the most common types of crashes involving learner motorcyclists as grouped according to VicRoads' crash coding system. A little more than half were single-vehicle (motorcyclist-only) crashes involving loss of control of the motorcycle (either on straight road sections or curves). A further one-fifth involved intersecting vehicles from adjacent or opposing directions. Smaller (less than 10%) proportions involved rear-end, sideswipe, and head-on (not overtaking) crashes. The curriculum focused on these five crash types as the most common scenarios involving learner motorcyclists in Victoria.

Table 3. Types of crashes involving learner motorcyclists in Victoria (2009–2013).

Crash Type	Proportion
Loss of control	52%
Intersecting	20%
Rear end	7%
Sideswipe	5%
Head on (not overtaking)	4%
Emerging	2%
Overtaking	2%
Manoeuvring	1%
Animal	1%
Object on path	1%

The target population of learner riders in Victoria was therefore mostly male and under 30 years of age, although most had at least three years of experience of controlling a (car-type) vehicle on-road. The risk of crashes for these learners was relatively high, especially for younger males. The nature of the most common crashes was indicative of learner status and lack of riding skill since the majority

of crashes involved the rider losing control of the motorcycle. This was also confirmed by further breakdown of the loss-of-control crashes, which identified that the majority (77%) occurred on straight road sections rather than on curves (23%), with the latter more often identified as a general contributing factor to crashes [16,17].

3.3. Specification of Tasks, Knowledge-Skills-Attitudes, and Assessment Requirements

For the additional steps of the Training Needs Analysis, specific content was explored in Australian and international curricula. Two Australia curricula were of particular relevance: the New South Wales (NSW) model [18], as it included more than one mandatory stage and had been adopted by other jurisdictions; and the Queensland Q-Ride model [19,20], as it was the only one to train learner course riders on-road. International models appraised spanned Europe (United Kingdom [21], Germany [22], and the European Commission [23]), North America (Canada [24] and the United States [25,26]), and Asia (Japan [27]).

The United Kingdom [21] and United States models (with [26] being a more specific application of [25]) were found to be the most specific to novices, with the other models showing close links to these. Their influence was also evident in Australia. However, Australian curricula showed greater progress in addressing tactical and strategic areas (roadcraft). This was typically in more advanced components near the end of a course, whereas international models tended to commence with an introduction to roadcraft. Another key difference was that international models included additional advanced topics such as riding with a passenger, breakdown procedures, towing, motorcycle maintenance, and group riding. Historically some of these topics had been included in Australian curricula, but were removed due to the prioritisation of content in courses of limited durations and the lack of relevance of some components (i.e., passengers and towing) as they became restricted for novices within the graduated licensing systems [5,28]. Based on these findings, the Australian curricula were deemed to be best suited to the M-GLS project needs overall.

The Australian models are guided by the Australian Quality Training Framework, the national set of standards for vocational education. Of particular relevance for the current project was the standard TLIC3038A Apply Safe Motorcycle Riding Behaviours [29], which defines the performance standard expected of an advanced rider, including “higher order riding skills and knowledge that build upon basic rider licence requirements”. Based on this standard, learning goals and performance criteria for novice versus experienced riders were specified and used to guide the knowledge, skills, attitudes, and assessment requirements for the three stages of the curriculum. Curriculum activities relative to these were then developed based on exemplar Australian and international curricula activities, tailored to the target population and crash problem, and based on behaviour change and adult learning principles, as discussed in the next section.

3.4. Teaching Approach and Structure of Activities

For the final Training Needs Analysis step, literature on behaviour change theories and adult learning was consulted to determine the principles that were to underpin the curriculum. Principles of early theories of behaviour were found to feature in several motorcycle curricula. These included causal attribution theory (which proposes that people attribute causes of events to either internal (e.g., personality) or external (i.e., situation, environment) factors, and that those who attribute external factors are less likely to apply safe behaviours [30]), cognitive dissonance theory (which proposes that there can be discord between people’s beliefs (e.g., that fatigue increases crash risk) and actual behaviour (e.g., riding while fatigued), and can be applied to identify and enhance rewards for safe behaviour [31]), and risk homeostasis theory (which proposes that people accept a certain level of risk that they seek to maintain, such that if a certain factor is viewed as reducing risk (e.g., riding a motorcycle with an anti-lock braking system), then other aspects of risk can be increased (e.g., riding faster, following closer, braking later) [32]). We further identified and considered more complex models of behaviour change that have since been proposed in social and health psychology fields [33].

Common elements in these theories included the importance of self-regulation, having specific and challenging goals for safe riding, and detailed plans on how to achieve these within one's own perceived capabilities, motivation, and self-efficacy. Targets of intervention within these models included modifying counterproductive appraisals of threat and coping, priming safety-orientated subjective norms and prototypes, and boosting perceived behavioural control. These mapped well to the self-evaluation column of the Goals for Rider Education framework.

Similar key elements were identified in literature on learning [34]. Learning was more likely to be effective when contextualised in the riders' own life experiences, when meeting intrinsic as well as extrinsic goals, and when creating self-awareness of abilities and self-confidence in learning. Content should be directly relevant and immediately applied, roles and responsibilities should be made explicit, and assessment should be self-directed, and involve critical and reflective thinking. Complex curricula should be managed by either reducing content or extending timeframes; afforded by the three-stage structure of the M-GLS curriculum.

Taking into account the analysis of the composition of the learner rider population, and the minimum learner age of 18 years in Victoria, the importance of following adult learning principles was emphasised. This required rider trainers to transition from more "pedagogical" (externally-focused) teaching approaches, where the instructor maintains responsibility for the learning, to more "androgical" (internally-focused) approaches, where the responsibility for learning transfers to the learner [35]. A transition from "training" only to "coaching" approaches is evident in the training literature both for novice drivers [36,37] and novice motorcyclists [38,39]. In coaching approaches, rather than administering standardised, predetermined lessons, individualised feedback is given to riders such that they learn based on their own experiences, stimulating self-reflection and self-analysis; well-aligned with the final column of the Goals for Rider Education framework. The new M-GLS education and assessment curriculum was designed to increasingly progress from traditional instruction and training to coaching, both within the pre-learner course (Motorcycle Permit Assessment), and from the pre-learner course to learner course (Check Ride) to pre-licence course (Motorcycle Licence Assessment) stages of the curriculum.

A series of activities was developed for delivery in small groups of up to five or six novice riders for the Motorcycle Permit Assessment and Check Ride. A small group size was used partly due to pre-specified project requirements for the Motorcycle Permit Assessment and practicalities for training providers for the Check Ride, but also because effective coaching of small groups of learners can exploit positive aspects of the social facilitation phenomenon [40]; for example, promoting enthusiastic and rewarding expression of one's own thoughts on challenging topics, such as using metacognitive skills to manage one's safety on the road.

The activities included classroom instruction, facilitated discussion, and practical training exercises, staged to address the increased expectations of TLIC3038A learning goals from novice to experienced rider, and with attention to each of the hierarchical levels of the Goals for Rider Education framework. The facilitated discussions in particular provided an opportunity to address the higher levels and the self-evaluation column of the framework directly, including attention to the key features of the behaviour change theories, and a focus on the five most common crash types. Each activity was structured in keeping with the core adult learning principles of the general Australian Standard TAE40110 Certificate IV in Training & Assessment [41] and the more specific TLIM4003A Develop Safe Motorcycle Riding Behaviours [42] for riding instructors, which can be summarised with the acronym MAPFORM, as follows:

- Meaningful: the "why", reason for learning.
- Active: engaging, connected, practical.
- Primacy and recency: first and last (points, activities) are most likely to be recalled and retained.
- Feedback: positive, immediate, one key point.
- Overlearning: practised beyond initial skill acquisition, change context not content, layered from simple to complex.

- Reinforcement: key words/phrases/sequences, in groups of three or five.
- Multi-sensory: seeing, hearing, and touch combined.

Accordingly, each activity was designed to commence with a brief introduction, including a link to previous learning where applicable, and then a more detailed explanation addressing three or five key points; both with attention to primacy and recency, such that the most important and immediately relevant points were made first and last. Next was a minimum of three practical demonstrations, with the exception of facilitated discussions for which demonstrations were replaced by scene settings. The first demonstration was a silent “normal” demonstration, the second a slow demonstration with verbal description, and the third the participants undertook together with the trainer (multi-sensory). This was followed by practice with a high number of repetitions (preferably until all participants demonstrated competency) and then feedback, or in the case of facilitated discussions, tasks were assigned and then discussions were undertaken. An emphasis on how to deliver feedback included first asking learners to self-identify their strengths and weaknesses in the given activity (in keeping with the final column in the Goals for Rider Education framework) and then coaching them on improvements where applicable. Each activity then ended with a recap or summary and a link to the next activity and/or “real-world” context.

The number, duration, and sequence of activities were designed to allow for interspersing different delivery media and locations (e.g., balance of classroom and range, including some facilitated discussion on-range), with shorter and longer breaks (e.g., transitioning from classroom to range, meal breaks) to help maximise attention and minimise fatigue—both for the trainers and the course participants—within constraints placed by the road authority (e.g., maximum range size, no new expensive equipment/technology, course duration limits). Care was also taken to include attention to roadcraft and higher levels of the Goals for Rider Education framework throughout, rather than solely at either the beginning or the end of the curriculum.

3.5. Assessments of Rider Competence

The assessments that were developed comprised a hybrid approach of testing and competency-based assessment. Testing is typically undertaken individually in standardised conditions applying a point scoring system with a pass/fail threshold value. Competency-based assessment can be undertaken individually or within a group and requires repeated demonstration of required skills to determine that competency has been achieved. Both approaches have strengths and weaknesses. In particular, testing can be viewed as more objective for examiners, but its “one chance” nature can unduly influence outcomes, such as false negatives (fails) due to candidates’ test anxiety or false positives (passes) “fluked” by incompetent riders. Conversely, competency-based assessment might better reduce false negative or positive results, but can be more challenging to standardise and requires more subjective judgment by examiners. While a move away from individual testing towards group competency-based assessments has been recognised [28], there was a need to balance this with the expectations of the road authority as well as those of the Victorian trainers; the vast majority of whom had no previous experience of delivering on-road rider training or assessment, particularly not with novices.

As such, a two-stage pre-learner Motorcycle Permit Assessment was developed with the first stage comprising an individual on-range vehicle-handling skills test, primarily addressing lower levels of the Goals for Rider Education hierarchy. This particularly included a higher than current standard of quick stop braking and slow riding, which was not only important to counter the single-vehicle loss-of-control crashes, but also provided reassurance to the road authority and trainers that the participants were ready to transition to the road to assess higher-level competencies. The second stage comprised a group-based on-road coaching ride and competency-based assessment, with riders participating in single file and rotating position. This design ensured that each rider had a turn in the lead position with the trainer/assessor in the second position in order to provide more targeted individual assessment and coaching. (Both the on-range and on-road assessments were undertaken

later on the second day of the pre-learner course, and first required the successful completion of a standard vision test and knowledge test on the first day, which were out-of-scope for revision within the current project.).

The subsequent learner stage Check Ride was specified not to be a test per se, but a coaching opportunity early in the learner period. This offered a chance to include learning activities that could not fit within the timeframe of the Motorcycle Permit Assessment course, but also those likely to be enhanced by having some riding experience following the assessment. A competency-based program was developed comprising on-range skills checks before proceeding to a multi-stage on-road ride. Each stage focused on one of the top five crash types and was designed to include relevant road features (e.g., same direction crashes on single lane roads, sideswipe on multi-lane roads, loss-of-control crashes on roads with curves). Facilitated discussion was undertaken before and after each stage focusing on the features and relevant tactics, as well as strategies when time permitted, relevant to avoiding the crash type. These discussions commenced by first prompting self-evaluation by the lead rider and then providing feedback, before opening up to other riders in the group, in keeping with addressing the higher-order skills of the Graduated Rider Education framework. As the Check Ride was not an assessment per se, participants could not “fail” the course, but should a serious safety incident occur, a “not complete” could be issued and the participant encouraged to undertake an individual lesson and/or (depending on the nature of the incident) gain more experience in low-risk riding environments before re-attending.

The final assessment to transition from a learner permit to licence was required to be undertaken individually on-road with pass/fail criteria. Therefore, it was designed to commence with competency-based on-range skills checks and then proceed to an on-road ride in test conditions, but with a more competency-based scoring approach (a stricter version of the pre-learner competency-based assessment).

To minimise scoring requirements for trainers managing small groups, including on-road, assessment sheets were developed that required only recording errors for which coaching feedback was required, or specified errors that contributed to pass/fail outcomes. While a positive scoring approach was preferred, in which multiple demonstrations of riding competencies could be tallied, the implications for an individual trainer/assessor to do this from a motorcycle and for multiple candidates together within a short space of time was impractical. A single-page, grid-like scoring system was developed, informed by the New Zealand competency-based assessment record sheets [43] and based on equivalent or adapted criteria from the Victorian Drive Test for novice car drivers [44], when applicable. Only errors that risked immediate danger/collision of the rider, others on the course, or any other road user were included as automatic fail errors.

In terms of higher-order skills assessment, it was deemed not feasible to test the two highest levels of the Graduated Rider Education framework specifically, such as by self-report measures (given that these are unlikely to be valid or reliable in this context [45]). Rather assessments allowed for scoring riders for any comments or on-road demonstrations contrary to expectations at these levels. Nonetheless it was acknowledged that it might be possible to develop some additional multiple-choice items within the knowledge test that could target some aspects of these levels more directly.

The resulting new M-GLS education and assessment curriculum is summarised visually in Figure 1, which presents a flow diagram of the overall process to progress from a pre-learner to a licensed rider. More specifically, Table 4 summarises the curriculum learning goals and activities within the Goals for Rider Education framework, together with the assessment requirements.

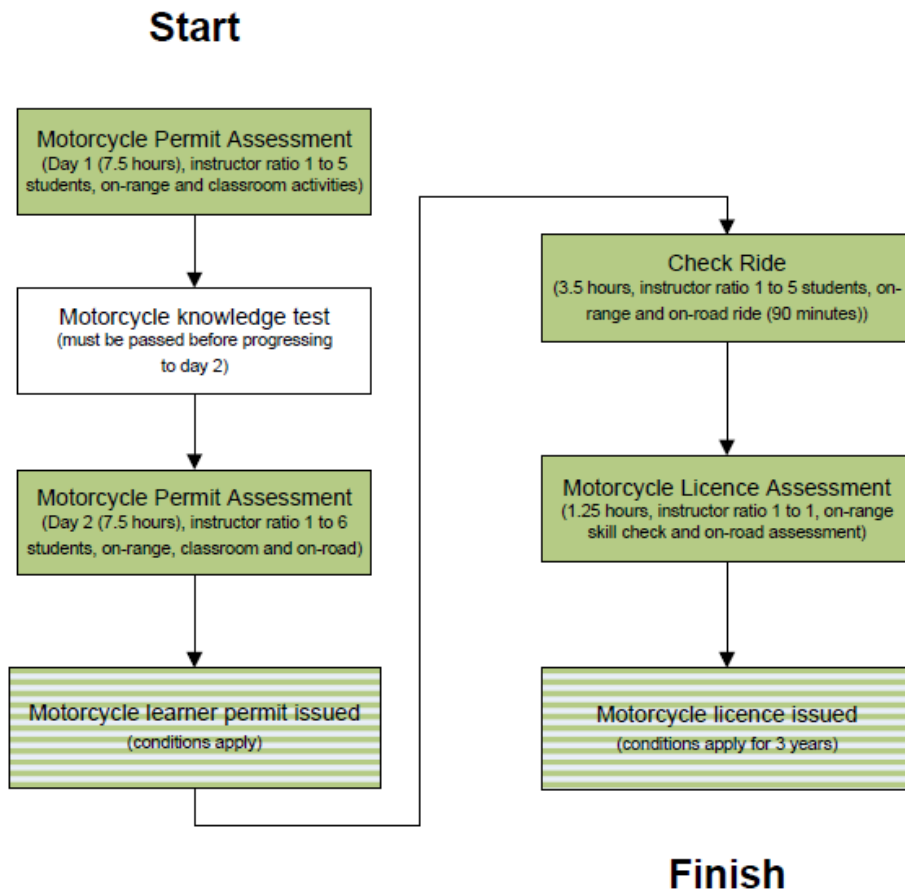


Figure 1. Overview of the Structure of the New M-GLS Education and Assessment Curriculum.

As noted above, the minimum motorcycle learner permit age in Victoria at the time of this research was 18 years, which continues to apply, as do the other timing requirements of the M-GLS. The motorcycle learner permit is required to be held for a minimum of three months before testing for a motorcycle licence (which is deemed a probationary or full licence depending on previous licensed driving experience) and otherwise expires after a maximum of 15 months. The Check Ride is required to be undertaken at a minimum of one month prior to attempting the licence assessment. Full details of Victoria’s final M-GLS, including additional requirements and restrictions at each stage, can be found on the VicRoads website (<https://www.vicroads.vic.gov.au/licences/licence-and-permit-types/motorcycle-licence-and-learner-permit>).

Table 4. Goals for Rider Education Tasks and Assessment Requirements.

Goals for Rider Education Level	Curriculum Learning Goals/Activities	Motorcycle Permit Assessment: On-Range	Motorcycle Permit Assessment: On-Road	Check Ride	Motorcycle Licence Assessment
Basic vehicle control (Operational level)	Perform vehicle pre-ride safety check	Not assessed	Not assessed	Briefly observed and discussed if own vehicle	Briefly observed and discussed if own vehicle
	Mount/dismount from side stand	Assessed	Feedback provided	Briefly observed and discussed	Assessed
	Operate controls (location and use without looking)	Assessed	Feedback provided	On deficiency	Assessed
	Move an unpowered motorcycle	Assessed	Not assessed	On opportunity	Not assessed
	Ride and stop an unpowered motorcycle (balance)	Competency-based observation	Not assessed	On opportunity	Not assessed
	Riding posture	Competency-based observation	Feedback provided	Briefly observed and discussed	Feedback provided
	Start/shutdown engine	Assessed	Feedback provided	On opportunity	Assessed
	Move and stop (clutch, brake control)	Assessed	Feedback provided	Observed and discussed in detail	Assessed
	Straight ride (clutch, accelerator and brake)	Assessed	Feedback provided	On deficiency	Assessed
	Changing gears (excluding automatic transmissions)	Competency-based observation	Feedback provided	Briefly observed and discussed	Assessed
	Slow riding, straight line, and tight turn	Assessed	Feedback provided	Observed and discussed in detail	Assessed
	Counter steering	Assessed	Feedback provided	On deficiency	Not directly assessed
	Braking (and down changing if manual) for curve	Competency-based observation	Feedback provided	Observed and discussed in detail	Assessed
	Ride curves	Assessed	Feedback provided	Observed and discussed in detail	Assessed
	Firm braking to a complete stop	Assessed	On opportunity	On opportunity	On opportunity
	Obstacle avoidance, not a quick swerve	Assessed	On opportunity	On opportunity	On opportunity
	Change of path	Assessed	Not assessed	On opportunity	On opportunity
	Riding in the rain	On opportunity	On opportunity, feedback provided	On opportunity	On opportunity
	Riding on loose/slippery surfaces	Not assessed	On opportunity, feedback provided	On opportunity	On opportunity
	Riding over bumps and broken surfaces	Not assessed	On opportunity, feedback provided	On opportunity	On opportunity

Table 4. Cont.

Goals for Rider Education Level	Curriculum Learning Goals/Activities	Motorcycle Permit Assessment: On-Range	Motorcycle Permit Assessment: On-Road	Check Ride	Motorcycle Licence Assessment
Management of traffic situations (Tactical level)	Apply road rules	Not assessed	Feedback and assessment	On deficiency	Assessed
	Use head checks and signals	Assessed	Feedback provided	Observed and discussed in detail	Assessed
	Comply with legal road position	Not assessed	Feedback provided	Observed and discussed in detail	Assessed
	Ride in light to moderate traffic	Not assessed	Essential	Observed and discussed in detail	Assessed
	Speed choice and management	Not assessed	Feedback provided	Observed and discussed in detail	Assessed
	Observation and vision	Assessed	Feedback provided	Observed and discussed in detail	Assessed
	Buffering	Not assessed	Feedback provided	Observed and discussed in detail	Assessed
	Crash avoidance space (including 3 s following distance)	Not assessed	Feedback provided	Observed and discussed in detail	Assessed
	Hazard perception (observe/perceive/respond; unique/random vs. constant)	Not assessed	Feedback provided	Observed and discussed in detail	Assessed
Take account of trip-related contexts (Strategic level)	Apply low-risk riding strategies appropriate to a planned trip	Not assessed	Feedback provided	Observed and discussed in detail	On deficiency
	Forecast riding events relevant to safety	Not assessed	Feedback provided	Observed and discussed in detail	On deficiency
	Apply strategies for riding safely with a group	Not assessed	Feedback provided	Observed and discussed in detail	Not assessed
	Wear personal protective equipment	Essential	Essential	Essential	Essential
Take account of personal characteristics, ambitions, and competencies (General level)	Apply safe motorcycle riding behaviours	Competency-based observation	Feedback and assessment	Observed and discussed in detail	Assessed
	Self-assess physiological and psychological fitness to ride	On observable deficiency	On observable deficiency	On observation and discussed in detail	On observable deficiency

4. Discussion

This research achieved the project objective of developing a three-stage education and assessment curriculum for licensing novice motorcyclists with a strong focus on awareness, judgment, and decision-making, and transitioning from an off-road testing model to including on-road coaching and competency-based assessments. A systematic approach was adopted to ensure that the curriculum would be commensurate with best practice. The guiding framework, Goals for Rider Education, was adapted from best practice in novice driver education, and Training Needs Analysis was used to tailor the content, structure, and teaching approach to the target population and crash types in keeping with the Australian Quality Framework Standards [29,41,42] and relevant Australian and international curricula [18–27]. This was grounded in theories of behaviour change and adult learning principles [30–35], with attention to addressing fatigue management for both trainers and course participants.

The matrix adopted for the Goals for Rider Education framework included four levels that had previously been applied in a European novice driver education curriculum [13]. It has also been proposed that there might be benefit in some applications of the GDE, such as in workplace training, in extending the model to separate out cultural, societal, and business influences as a fifth but reciprocal level to the fourth level focusing on personal influences [46,47]. This was not the focus in this initial curriculum for a general novice motorcyclist population, but might be worth exploring in the future, particularly for workplace motorcyclist training.

The Training Needs Analysis identified that the Victorian learner rider population was largely male and aged under 30 years, although most had at least three years of driving experience. This contrasted to the neighbouring and most populous state in Australia, NSW, where novice riders are more likely to be slightly older on average, despite a one-year lower minimum licensing age of 17 years [48]. Young males also comprised a large proportion of learner motorcyclists involved in crashes, which is commensurate with research in NSW and internationally that identifies young age and inexperience as leading factors in motorcyclist crashes [7–9,17]. Nonetheless, learner riders in crashes included those aged 60 years or older. The adult learning and coaching approaches applied to the curriculum ensured applicability across a wide age range and for differing levels of riding experience and capabilities.

The most common crash types, loss-of-control, intersecting, rear-end, sideswipe, and head-on (not overtaking), also were not dissimilar to those identified in other Australian jurisdictions and internationally [8,16,17,49]. However, that more than half comprised single-vehicle loss-of-control crashes was unusually high, as was the finding that the majority of these were on straight road sections rather than at curves [16,17]. These findings therefore confirmed that the over-representation of learner motorcyclists in Victorian casualty crashes was consistent with the lack of skill that might be expected for novice riders and that a higher standard of assessment of basic vehicle-handling (operational) skills was needed in addition to higher-level roadcraft skills and self-reflection, monitoring, and evaluation skills. Including a strong focus on common crash types and the contributing factors to these, which apply widely across many crash scenarios, also suggests that the curriculum will be applicable to other jurisdictions.

While the use of coaching was included as an important feature of the curriculum, it is noteworthy that, towards the end of the project, an evaluation of another motorcycle coaching program in Victoria was published finding a lack of support for the approach [39]. The randomised control trial not only found no evidence of safety improvements, but also indications of miscalibration, such that trained participants were more likely to report speeding behaviour compared to controls. However, the evaluated program was voluntary, aimed to improve the skills of already licensed riders, and suffered from several delivery challenges [50], including difficulties in recruiting and retaining participants, non-co-operative participants, and difficulties ensuring that a coaching approach was implemented. While the latter difficulty might well apply to the new M-GLS curriculum, participant difficulties are less applicable in a mandatory curriculum for licensure. Overall, the intent and target population of

the evaluated program differed substantially to the M-GLS curriculum, which seeks to develop safe riding practices from the outset, focusing on novices seeking to learn how to ride a motorcycle for the first time and progress to a competent level.

4.1. Strengths and Limitations

The literature review undertaken at the outset of this project identified that very little detail on the development and actual content and structure of training and assessment curricula for motorcycle licensing is available in the public domain. This includes rider training evaluations, which tend to provide brief overviews of the programs in general terms due to the necessary focus on details of the evaluation methods. This limits understanding in order to develop best-practice guidelines for the field and, importantly, to avoid replication of ineffective curricula. This paper addresses this gap in the literature by documenting the development of Victoria's M-GLS curriculum in detail in order to lay the foundation for determining best practice for the field in the future.

While the M-GLS curriculum was designed to represent best practice, this can only be determined via thorough evaluation. Limitations to the curriculum development included some imposed by the state road authority, for which the implications are unknown. These included restricting the durations of the courses developed at each of the three stages (Motorcycle Permit Assessment maximum two days; Check Ride a half-day, Motorcycle Licence Assessment approximately one hour), limiting the maximum range size to that of the smallest existing range (limiting the speeds that could be reached prior to transitioning to the road), and restricting the introduction of any expensive equipment or new technologies. Introduction of more specific hazard perception skills training and assessment was also precluded (due to a pre-existing contract). While it was agreed that technologies such as devices for communicating while on-road might introduce distraction risks [51], there is emerging support for road safety benefits of computer-based training of skills such as hazard perception among drivers, including young novice drivers [52], with calls for such programs to be developed for motorcyclists [53]. Therefore, additional enhancements could emerge in the future.

In addition, while group-based competency assessment and scoring approaches were incorporated, the Motorcycle Permit Assessment range and Motorcycle Licence Assessment on-road components were required to be undertaken individually in test conditions. There is limited literature to propose whether this hybrid approach will increase safety over pure end-testing or if the Motorcycle Permit Assessment range test could be removed and the Motorcycle Licence Assessment changed to a group competency-based assessment. Furthermore, ideally hundreds of participants should first be assessed to determine standardised pass/fail thresholds for the scoring systems developed [54]. This will only be achieved when the M-GLS has been in place for several months and therefore requires review. Importantly, continued monitoring and evaluation of the curriculum is in progress by the state government and will ensure that any further refinements that are needed will be identified and remedied in the future, and a full outcome evaluation is planned.

4.2. Conclusions

The systematic approach undertaken to align the new M-GLS education and assessment with best practice, and its on-going monitoring and evaluation, provide a promising foundation to inform best practice in novice motorcyclist education to improve the safety of newly-licensed novice riders.

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overview and curriculum materials; Senserrick wrote the first draft of this manuscript; all other authors reviewed and contributed directly to this manuscript.

Conflicts of Interest: The authors declare no conflict of interest in development of the curriculum or its reporting. The funding sponsor set some limitations on the scope of the curriculum, as documented in the manuscript. The authors previously and might in the future respond to VicRoads' requests for tenders for other road safety work, which might include further research related to this project. The funder placed no limitations on the writing or publication of this manuscript.

References

1. Australian Bureau of Statistics. *Motor Vehicle Census, Australia, 31 January 2015, Cat. No. 9309.0*; ABS: Canberra, Australia, 2015.
2. Bureau of Infrastructure, Transport and Regional Economics. *Road Deaths Australia, 2013 Statistical Summary*; BITRE: Canberra, Australia, 2014.
3. Australian Transport Council. *National Road Safety Strategy 2011–2020*; Canberra ACT: Canberra, Australia, 2011.
4. Transport for NSW, NSW Government. *NSW Motorcycle Safety Strategy 2012–2021*; TfNSW: Sydney, Australia, 2012.
5. Senserrick, T.; Ivers, R.; Boufous, S.; Stevenson, M. *Safer Road Use: A Territory Imperative—The Introduction of Comprehensive Graduated Driver & Rider Licensing Systems for the Northern Territory: Phase 2. Report to the Northern Territory Department of Planning and Infrastructure*; The George Institute for Global Health: Sydney, Australia, 2009.
6. VicRoads. *Graduated Licensing for Motorcyclists: A Discussion Paper*; VicRoads: Kew, Australia, 2010.
7. Australian Transport Safety Bureau. *Motorcycle Rider Age and Risk of Fatal Injury. Motorcycle Safety Monograph 12*; ATSB: Canberra, Australia, 2002.
8. De Rome, L.; Senserrick, T. Factors associated with motorcycle crashes in New South Wales, Australia, 2004–2008. *Transp. Res. Rec.* **2011**, *2265*, 54–61. [[CrossRef](#)]
9. Lin, M.R.; Kraus, J.F. A review of risk factors and patterns of motorcycle injuries. *Acc. Anal. Prev.* **2009**, *41*, 710–722. [[CrossRef](#)] [[PubMed](#)]
10. Haworth, N.L.; Mulvihill, C. *Review of Motorcycle Licensing and Training. MUARC Report 165*; Monash University Accident Research Centre: Clayton, Australia, 2005.
11. Kardamanidis, K.; Martiniuk, A.; Ivers, R.Q.; Stevenson, M.; Thistlewaite, K. Motorcycle rider training for the prevention of road traffic crashes. *Cochrane Database Syst. Rev.* **2010**, *10*, CD005240.
12. Senserrick, T.; Mitsopoulos-Rubens, E. Behavioural adaptation and novice drivers. In *Behavioural Adaptation and Road Safety: Theory, Evidence and Action*; Rudin-Brown, M., Jamson, S., Eds.; CRC Press, Taylor & Francis: Boca Raton, FL, USA, 2013; pp. 245–263.
13. The International Commission for Driver Testing (CIECA). *Integrating the GDE Matrix into Category B Driver Training and the Practical Driving Test. Final Report*; CEICA: Brussels, Belgium, 2007.
14. Hatakka, M.; Keskinen, E.; Gregersen, N.P.; Glad, A.; Hernetkoski, K. From control of the vehicle to personal self-control; broadening the perspectives to driver education. *Transp. Res. Part F Traffic Psychol. Behav.* **2002**, *5*, 201–215. [[CrossRef](#)]
15. Berg, H.-Y. Reducing crashes and injuries among young drivers: What kind of prevention should we be focusing on? *Inj. Prev.* **2006**, *12* (Suppl. 1), i15–i18. [[CrossRef](#)] [[PubMed](#)]
16. OECD/ITF. *Improving Safety for Motorcycle, Scooter and Moped Riders*; OECD Publishing: Paris, France, 2015.
17. Preusser, D.F.; Williams, A.F.; Ulmer, R.G. Analysis of fatal motorcycle crashes: Crash typing. *Acc. Anal. Prev.* **1995**, *27*, 845–851. [[CrossRef](#)]
18. Roads and Traffic Authority of NSW. *Pre-Learner Rider Training*; RTA: Sydney, Australia, 2008.
19. Queensland Transport. *Consistent Assessment Process: Version 4.0—December 2013*; Department of Transport and Main Roads, Queensland Government: Brisbane, Australia, 2013.
20. Queensland Transport. *Q-Ride Competency Standards: Version 6.1—December 2013*; Department of Transport and Main Roads, Queensland Government: Brisbane, Australia, 2013.
21. Driving Standards Agency. *Safe and Responsible Riding: Version 4.1—18 December 2012*; DSA, UK Government: London, UK, 2012.

22. Kuschefski, A.; Haasper, E.; Vallese, A. *Survey of the Actual State of the Initial Rider Training for Motorcycle Riders in Germany*; Institute for Motorcycle Safety: Essen, Germany, 2012.
23. European Commission. *The IRT Model—European Initial Rider Training Programme*; Publications Office of the European Union: Luxembourg, 2011.
24. Ministry of Transport. Licence Types: Ontario, Canada. Available online: <http://www.mto.gov.on.ca/english/dandv/driver/classes.shtml> (accessed on 30 July 2014).
25. National Highway Traffic Safety Administration (prepared by Windwalker Corporation and Highway Safety Services LLC). *Model National Standards for Entry-Level Motorcycle Rider Training*. DOT HS 811 503; NHTSA: Washington, DC, USA, 2011.
26. Motorcycle Safety Foundation. *Basic Rider Course: Rider Handbook 7.1*; MSF: Irvine, CA, USA, 2008.
27. Nagoya International Center. Motorcycle Licences in Japan. Available online: <http://www.nic-nagoya.or.jp/en/e/archives/4524> (accessed on 30 July 2014).
28. Christie, R. *A Discussion Paper on Elements of Graduated Licensing Systems for Motorcycle Riders*. Austroads Research Report AP-R469-14; Austroads: Sydney, NSW, Australia, 2014.
29. Australian Government. Unit of Competency Details: TLIC3038A—Apply Safe Motorcycle Riding Behaviours (Release 1). Available online: <https://training.gov.au/Training/Details/TLIC3038A> (accessed on 16 June 2014).
30. Heider, F. *The Psychology of Interpersonal Relations*; Lawrence Erlbaum: Hillsdale, NJ, USA, 1958.
31. Festinger, L. *A Theory of Cognitive Dissonance*; Row: Evanston, IL, USA, 1957.
32. Wilde, G.J.S. The theory of risk homeostasis: implications for safety and health. *Risk Anal.* **1982**, *2*, 209–225. [[CrossRef](#)]
33. Webb, T.L.; Sniehotta, F.F.; Michie, S. Using theories of behaviour change to inform interventions for addictive behaviours. *Addiction* **2010**, *105*, 1879–1892. [[CrossRef](#)] [[PubMed](#)]
34. Choy, S.; Delahaye, B. Attending to a new ‘species’ of learners: Principles for facilitating youth learning. *Quest* **2007**, *7*, 6–9.
35. Knowles, M. *The Modern Practice of Adult Education: From Pedagogy to Andragogy*; Prentice Hall/Cambridge: Englewood Cliffs, NJ, USA, 1970.
36. HERMES. EU HERMES Project: Final Report. High Impact Approach for Enhancing Road Safety through More Effective Communication Skills in the Context of Category B Driver Training. Available online: www.alles-fuehrerschein.at/HERMES (accessed on 30 July 2014).
37. Stanton, N.A.; Walker, G.H.; Young, M.S.; Kazi, T.; Salmon, P.M. Changing drivers’ minds: The evaluation of an advanced driver coaching system. *Ergonomics* **2007**, *50*, 1209–1234. [[CrossRef](#)] [[PubMed](#)]
38. Ormston, R.; Dudleston, A.; Pearson, S.; Stradling, S. *Evaluation of Bikesafe Scotland*. Research Findings No.169/2003; Scottish Executive Social Research: Edinburgh, UK, 2003.
39. Ivers, R.; Sakashita, C.; Senserrick, T.; Elkington, J.; Lo, S.; Boufous, S.; de Rome, L. Does an on-road motorcycle coaching program reduce crashes in novice riders: A randomised control trial? *Acc. Anal. Prev.* **2015**, *86*, 40–46. [[CrossRef](#)] [[PubMed](#)]
40. Aiello, J.R.; Douthitt, E.A. Social facilitation from triplett to electronic performance monitoring. *Group Dyn. Theory Res. Pract.* **2001**, *5*, 163–180. [[CrossRef](#)]
41. Australian Government. Unit of Competency Details: TAE40110 Certificate IV in Training & Assessment (Release 3). Available online: <https://training.gov.au/Training/Details/TAE40110> (accessed on 16 June 2014).
42. Australian Government. Unit of Competency Details: TLIM4003A Develop Safe Motorcycle Riding Behaviours (Release 1). Available online: <https://training.gov.au/Training/Details/TLIM4003A> (accessed on 16 June 2014).
43. NZ Transport Agency. *Motorcycle Competency-Based Training and Assessment (CBTA) Course Guide*; New Zealand Government: Wellington, New Zealand, 2014.
44. VicRoads. *VicRoads Drive Test: Licence Testing Officer’s Manual*; VicRoads: Kew, Australia, 2009.
45. Senserrick, T.; Hatfield, J.; Williamson, A. *Why Mandatory Psychological Testing of All Young Novice Drivers Is Unlikely to Reduce Crashes*; International Conference on Traffic Transport Psychology: Brisbane, Australia, 2016.

46. Keskinen, E.; Peräaho, M.; Laapotti, S.; Katila, A.; Hernetkoski, K. Ehdotus Kolmivaiheiseksi Kuljettajaopetuksesi B-Luokan Ajo-Oikeutta Varten, Trafin Julkaisuja 7/2010. Report by the Finnish Transport Safety Agency (Trafi), Helsinki Helsingfors. 2010. Available online: http://www.trafi.fi/filebank/a/1322215719/907704a51c681d3028e27b6af27a35ea/1668-Trafi7-2010Ehdotus_kolmivaiheiseksi_kuljettajaopetuksesi.pdf (accessed on 24 January 2017).
47. The International Commission for Driver Testing (CIECA). *Framework for a Curriculum (or Blueprint) for Driver Education. Proposal for Discussion. Blueprint WG 2—Version 2.1—25th June 2014*; CEICA: Brussels, Belgium, 2014; Available online: http://www.asociaceautoskol.cz/admin/files/2014/WG2_Proposal-Framework-WG2-June2014.pdf (accessed on 24 January 2017).
48. Watson, B.; Tunnicliff, D.; White, K.; Schonfeld, C.; Wishart, D. *Psychological and Social Factors Influencing Motorcycle Rider Intentions and Behaviour Report 2007–04*; Australian Transport Safety Bureau: Canberra, ACT, Australia, 2007.
49. de Rome, L.; Ivers, R.; Haworth, N.; Heritier, S.; Fitzharris, M.; Du, W. A survey of novice riders and their riding experience prior to licensing. *Transp. Res. Rec.* **2010**, *2194*, 75–81. [[CrossRef](#)]
50. Russell, M.; Fotheringham, N.; Mulvihill, C. Assisted Rides—A Large-Scale Trial of a Motorcycle Coaching Program. In *Proceedings of the 2015 Australasian Road Safety Conference, Gold Coast, Australia, 14–16 October 2015*.
51. Da Silva, D.W.; de Andrade, S.M.; Soares, D.F.; Mathias, T.A.; Matsuo, T.; de Souza, R.K. Factors associated with road accidents among Brazilian motorcycle couriers. *Sci. World J.* **2012**, *2012*, 605480. [[CrossRef](#)] [[PubMed](#)]
52. Taylor, T.; Pradhan, A.K.; Divekar, G.; Romoser, M.; Muttart, J.; Gomez, R.; Pollatsek, A.; Fisher, D.L. Long term effects of hazard anticipation training on novice drivers measured on the open road. *Accid. Anal. Prev.* **2013**, *58*, 175–186. [[CrossRef](#)] [[PubMed](#)]
53. Haworth, N.L.; Rowden, P.J.; Wishart, D.E.; Buckley, L.; Greig, K.; Watson, B.C. *Motorcycle Rider Safety Project Summary Report*; Queensland Department of Transport and Main Roads: Brisbane, Australia, 2012.
54. AERA; APA; NCME. *Standards for Educational and Psychological Testing*; American Psychological Association: Washington, DC, USA, 2014.



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