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Understanding Young Rider's Behaviour through In-Depth Interviews

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Young riders of light motorcycles (A1) face a substantially elevated crash risk, with rates of serious injury and fatality reported to be more than fifty times higher than those of car drivers. Limited riding experience, inappropriate speed adaptation, and insufficient hazard anticipation are consistently identified as central characteristics in severe motorcycle crashes involving young riders. Despite comprehensive formal training, this group remains markedly overrepresented in loss-of-control and interaction-related crashes.
The present article forms part of a broader research project examining the behaviour of young A1 riders through a combination of empirical methods, including mobile eye-tracking during real-world riding, retrospective video-assisted interviews, and in-depth interviews focusing on riders' own reflections on their behaviour in traffic. While the larger study explores several aspects of novice riders' behaviour, the current article specifically examines the riders' articulated plans, strategies, and interpretations of their own riding behaviour based on the in-depth interview material.
Eighteen novice riders aged 16–18 participated in the study. Through semi-structured in-depth interviews, participants were invited to reflect on their riding experience and to describe the considerations, strategies, and decision-making processes that guide their behaviour in traffic situations.
By focusing on how riders themselves describe and rationalize their behaviour, the analysis provides insight into the cognitive and interpretative frameworks that shape their tactical choices in traffic. Particular attention is directed towards how young riders conceptualize safety margins, anticipate potential hazards, and understand their own role in interaction with other road users.
Based on this, the research question was formulated as follows: *What plans and strategies do young A1 motorcycle riders employ when navigating intersections and curves?*

Keywords: A1, Light Motorcycle, Young Riders, In-Depth Interviews, Traffic Safety

1. Introduction

Adolescents in Norway use motorised vehicles to travel between home and school, participate in leisure activities, and commute to and from work. At the same time, vehicles are used for social activities as well as recreation and enjoyment (Wold, T., & Wigum, J.P. 2024). The A1 licence (light motorcycle) therefore represents a relevant transport option for young people aged 16–18. After the age of 18, most individuals will typically acquire a car driving licence. Adolescent road users constitute a particularly vulnerable group. According to the Institute of Transport Economics (TØI, 2018), young riders of light motorcycles (A1) face a relatively high crash risk during their first year after licensing. In Norway, the authorities have recently debated whether increasing the minimum age requirement could constitute an effective measure to reduce crash involvement among young A1 motorcycle riders (Norwegian Public Roads Administration [NPRA], 2025). Additional regulatory measures have also been considered, including periodic vehicle inspections, mandatory use of protective riding equipment, and restrictions on carrying passengers. The present study aims to examine the cognitive processes employed by this age group in traffic situations, to assess whether targeted educational interventions may also contribute to a reduction in future crash risk.

2. Theoretical framework

The Norwegian driver education system is grounded in the framework *Goals for Driver Education*, which articulates the overarching objectives of driver training (Peräaho, Keskinen, & Hatakka, 2003). This framework builds on earlier work by McKnight and Adams (1970), who identified approximately 1,700 discrete tasks associated with driving. These tasks were subsequently structured by Michon (1985) into a hierarchical model consisting of three levels: strategic, tactical, and operational control.

Within the European research project GADGET (Guarding Automobile Drivers through Guidance, Education, and Technology), this hierarchical perspective formed the basis for the development of the Goals for Driver Education (GDE) matrix (Christ et al., 1999; E. Keskinen, 1996). The GDE matrix (E. Keskinen, 1996; Peräaho et al., 2003) expands the original hierarchy into four interrelated levels and has since been implemented as a foundational framework for driver education across all licence classes in Norway. In 2010, a fifth level was added to explicitly account for the role of social environment, lifestyle, and broader societal influences in shaping young individuals' mobility choices and risk behaviour (E. Keskinen, Peräaho, & Laapotti, 2010).

The GDE matrix thus represents a comprehensive and multi-layered approach to driver education, emphasizing that safe driving is not solely a matter of vehicle handling and rule compliance, but also of higher-order cognitive processes, self-regulation, and contextual awareness. By incorporating motivational, social, and environmental dimensions alongside perceptual and operational skills, the framework provides a theoretical basis for understanding how driving behaviour emerges from the interaction between individual cognition and situational demands. In this way, the Norwegian driver education system, informed by the GDE matrix, acknowledges the complexity of driving and underscores the necessity of holistic training approaches that extend well beyond technical vehicle operation alone. Within the GDE framework, riding a light motorcycle (A1) represents a particularly critical context, as young riders typically operate at an early stage of development across several GDE levels. While basic vehicle control and tactical manoeuvring may be rapidly acquired, limitations are often observed at higher levels related to hazard anticipation, self-regulation, and risk awareness. For A1 riders, social influences, identity formation, and lifestyle choices play a pronounced role in shaping riding behaviour, corresponding to the upper levels of the GDE matrix. Applying the GDE perspective to A1 riders therefore enables a nuanced understanding of how perceptual processes, decision-making, and motivational factors interact, and why targeted educational interventions must address more than technical riding skills. The curriculum for the A1 licence in Norway (NPRA, 2016) is explicitly aligned with the hierarchical structure of the GDE matrix. At the lower levels, the curriculum emphasises basic vehicle control, braking, and manoeuvring skills, ensuring that riders develop adequate operational competence. At the tactical level, attention is directed towards traffic interaction, positioning, speed choice, and hazard perception in varied traffic environments. The higher GDE levels are addressed through learning objectives related to risk awareness, self-assessment, and decision-making, including reflection on own limitations and consequences of risky behaviour. Furthermore, the curriculum highlights attitudes, motivation, and social influences, thereby integrating lifestyle and contextual factors that shape young riders' behaviour beyond the immediate riding task.

A assessment of serious crashes involving ATVs, mopeds, and motorcycles in the period 2015–2020 indicates a substantial increase in the number of registered light, medium and heavy motorcycles, alongside a total of 2,067 crashes involving these vehicle categories (Iversen & Njå, 2022). Of these incidents, 32% resulted in fatalities or serious injuries to drivers or passengers. Earlier research has documented systematic differences between motorcycle crashes and crashes involving other types of vehicles, particularly with respect to contributing factors and risk profiles. These indicate that motorcyclists are substantially more exposed than other groups of road users. (Høye, 2017; Høye et al., 2016).

In motorcycle crashes, rider competence emerges as a central factor, encompassing traffic competence, vehicle familiarity, and riding experience. This highlights the critical interaction between rider competence and road design, as well as between rider competence and specific traffic situations. Both run-off-road crashes and head-on collisions show an increasing prevalence in sharp curves over time, underscoring the need for further investigation into how changes in road alignment and crossfall influence crash risk for motorcyclists. It appears that insufficient information acquisition and a limited ability to anticipate critical events may be contributing factors in some of these crashes. (Sagberg et al., 2020).

Light motorcycles (A1) represent a particularly vulnerable vehicle category in the Norwegian road traffic system. An assessment of crash data from 2015 to 2024 shows that riders of light motorcycles face an exceptionally high level of risk compared to other road users. When exposure is considered, the risk of being killed or seriously injured per kilometre travelled is more than fifty times higher for light motorcycle riders than for car drivers (Norwegian Public Roads Administration [NPRA], 2025).

Young riders are strongly overrepresented in the most severe crashes. Approximately 70 percent of those killed or seriously injured on light motorcycles during the

period were 16–17 years old, despite this age group representing a small proportion of overall traffic volume. The situation has worsened in recent years, with particularly high numbers of serious injuries and fatalities recorded in 2023 and 2024. The crash pattern is dominated by run-off-road crashes and conflicts involving crossing or opposing traffic, suggesting challenges related to speed adaptation, hazard anticipation, and interaction with other road users rather than purely technical vehicle factors (NPRA, 2025).

Overall, the findings indicate that light motorcycle riding among young and inexperienced riders constitutes a disproportionate safety risk. The report concludes that raising the minimum age requirement for A1 licences from 16 to 18 years would likely result in a substantial reduction in serious injuries and fatalities, making it one of the most effective available countermeasures targeting this high-risk group (NPRA, 2025). Investigations conducted by the Norwegian Accident Investigation Board demonstrate that crashes involving young riders on light motorcycles (A1) are characterised by a convergence of behavioural, technical, and infrastructural risk factors rather than isolated rider errors. Based on analyses of four fatal crashes involving riders aged 16–17 years, the investigation identifies recurring challenges related to speed adaptation, limited experience, insufficient anticipation of hazards, and delayed or inappropriate braking, particularly in curves, at crests, and in interaction with other road users (Statens havarikommisjon, 2025). These behavioural factors were frequently exacerbated by deficiencies in vehicle condition, such as worn components, incorrect tyre pressure, and reduced suspension performance, as well as by road environments with limited sight distance and unforgiving roadside design.

3. Methods

3.1. *Participants*

Eighteen participants aged 16–18 years were included in the study. They were recruited through social media platforms as well as via driving schools, which distributed an invitation to participate on behalf of the research team. Through this recruitment approach, the sample was randomly selected. The sample consisted of 17 male participants and one female participant. Riding experience ranged from approximately 2,000 to 12,000 kilometres within a single riding season. The motorcycle was used for both utilitarian purposes and leisure riding.

3.2. *Interview guide*

The interviews followed a semi-structured interview guide. The guide was structured around key thematic areas, including the interviewees' background, riding experience, and general approaches to traffic situations. In addition, participants were asked to reflect on their perceptions, decision-making processes, and risk assessments in specific riding contexts.

3.3. *The article authors*

All authors of the article, except for one, are actively involved in the education of motorcycle riding instructors in Norway (Nord University, 2024) and possess extensive experience in instructional practice within authentic educational settings. In addition, two of the authors have professional experience as examiners for practical motorcycle riding tests. The remaining author has previously conducted research on youth and motorised mobility, with a particular focus on all-terrain vehicles (ATVs) and utility terrain vehicles (UTVs).

3.4. *The interviews*

The study identified four distinct Areas of Interest (AOIs), which were selected to represent traffic situations that are particularly relevant to safety and rider decision-making. During the interviews, these four situations were presented on a screen using video recordings from a forward-facing camera mounted on the motorcycle, allowing participants to observe and reflect on their own riding behaviour. The interview guide therefore included situation-specific questions related to each AOI.

The interviews addressed both strategic decisions made prior to entering the AOIs, such as route planning, speed choice, and positioning, and tactical decisions executed during riding in specific situations, including visual scanning, timing of actions, and interactions with other road users. This approach enabled a detailed exploration of how inexperienced riders interpret, anticipate, and respond to demanding traffic environments.

3.5. Analysis

The analytical framework employed in this study is Braun and Clarke's (2006) thematic analysis. However, this approach provides limited procedural guidance for analyses involving multiple researchers. To address this limitation, we adopted Helga Eggebø's (2020) concept of *collective qualitative analysis*, which builds on the principles of thematic analysis while offering a more explicit structure for collaborative analytical processes.

The analysis was conducted through a series of working meetings in which interpretations of the transcribed interviews and emerging themes were systematically discussed, refined, and, where necessary, revised. Through critical scrutiny of each other's interpretations and an explicit requirement for transparency and analytical substantiation, the collective qualitative approach contributed to strengthening the credibility, reliability, and validity of the findings presented.

3.6. Ethics

All participants were thoroughly informed about the objectives of the study and any potential risks associated with participation. Written informed consent was obtained from each participant prior to data collection. The project was approved by Sikt: Norwegian Agency for Shared Services in Education and Research (SIKT, 2023), formerly known as the Norwegian Centre for Research Data (NSD), and was conducted in accordance with the principles of the General Data Protection Regulation (GDPR).

4. Results

Table 1 Results of In-depth interviews

Factors related to Young Rider´s Behaviour	Illustrative explanation
1 Strong Self-Confidence combined with limited trust in other road users	The participants express strong confidence in their own judgements, combined with skepticism towards the behaviour of other road users.
2 Predominantly training-driven tactical choices with limited situational adaptation	Riding behaviour in curves and curve combinations is largely rule- and training-based, with limited ability to adapt speed, lane and positioning.
3 Reactive rather than predictive riding behaviour	Braking and deviations in positioning are primarily described as responses to undesirable events rather than as elements of a proactive riding strategy.

4.1. *Strong Self-Confidence combined with limited trust in other road users*

Across the interviews, participants consistently described themselves as riders who are aware of risk and who actively try to avoid unnecessary danger. At the same time, many expressed strong confidence in their own experience and judgement, while showing limited trust in the behaviour of other road users. This pattern indicates a strong emphasis on self-perceived competence and personal responsibility in how riders understand their own behaviour.

Such self-confidence may support decisive and intentional riding behaviour. However, it may also become problematic if it leads riders to rely too heavily on their own assessments while underestimating the unpredictability of other road users. When riders assume that safety can largely be controlled through their own skills, they may be less inclined to maintain wide safety margins or to prepare for unexpected actions by others. In complex traffic situations that require cooperation, early anticipation, and defensive strategies, this combination may reduce safety margins and increase crash risk.

4.2. *Predominantly training-driven tactical choices with limited situational adaptation*

In situations involving curves, curve combinations, and road positioning, participants' descriptions were largely characterized by training-based rules, such as choosing the "straightest possible line" and maintaining a steady speed through curves. These strategies closely reflect formal instruction and assessment criteria and indicate functional competence at the tactical level of rider behaviour. However, beyond referring to these general principles, the interviews revealed limited ability to explain how tactical decisions were adjusted to changing traffic situations.

Descriptions of speed choice, throttle use, and braking were often general and lacked clear reference to specific situational cues, such as reduced sight distance, variations in road surface, curve sharpness, or the behaviour of other road users. Tactical decisions were typically described as the application of learned rules rather than as outcomes of continuous observation and anticipation. This suggests that riders' tactical behaviour is not always guided by an active reading of the situation ahead.

As a result, the use of training-based rules may work well in predictable conditions but offer less support when riding conditions become more complex or demanding. In such situations, limited situational adaptation may reduce safety margins and increase vulnerability, particularly in curves and curve combinations, which are frequently involved in serious motorcycle crashes.

4.3. *Reactive rather than predictive riding behaviour*

Participants frequently described braking in curves as a response to unexpected or undesirable events rather than as a proactive safety strategy. Braking was often perceived as having a stabilizing or corrective function, but was primarily used reactively, suggesting limited anticipation during riding. Similarly, surface hazards such as potholes and cracks were generally avoided, yet these actions were described as isolated responses rather than as part of a continuous, forward-looking riding strategy.

This reactive orientation indicates that control actions are not always supported by anticipatory planning or by early interpretation of developing traffic situations. When adjustments are made late and under time pressure, the available safety margins are reduced. In demanding riding situations, this may increase vulnerability and contribute to a higher risk of loss of control or serious crashes.

5. Discussion

5.1. *Strong Self-Confidence combined with limited trust in other road users*

The finding that young A1 riders consistently describe themselves as risk-aware while simultaneously expressing strong confidence in their own judgement and limited trust in other road users reflects a central tension in early rider development. On the one hand, these self-descriptions align closely with the intentions of the Norwegian driver education system, which emphasizes responsibility, self-assessment, and conscious risk management as core learning outcomes (Peräaho, Keskinen, & Hatakka, 2003). The interviews suggest that participants have internalized key normative messages from training, particularly those related to personal responsibility and avoidance of overtly risky behaviour. This internalization indicates learning processes that extend beyond operational riding skills and into higher-order cognitive and motivational domains, as conceptualized within the GDE framework (E. Keskinen, 1996; Christ et al., 1999).

However, when interpreted considering crash statistics and prior motorcycle safety research, this strong self-confidence also emerges as a potential vulnerability rather than an unequivocal protective factor. Although confidence may support decisiveness and reduce hesitation, it may simultaneously foster an overreliance on one's own hazard perception and response in complex and dynamic traffic environments. The limited trust expressed in other road users is particularly salient in this regard. Rather than translating into systematically conservative safety margins, skepticism towards others may reinforce an individualistic riding logic, where safety is primarily perceived as controllable through one's own competence alone. Such a perspective contrasts with the GDE matrix's emphasis on interaction, contextual awareness, and adaptive self-regulation as prerequisites for safe driving and riding (E. Keskinen et al., 2010).

This pattern resonates with earlier findings indicating that many serious motorcycle crashes are not primarily attributable to inadequate vehicle handling, but to shortcomings in information acquisition and hazard anticipation (Sagberg et al., 2020). In this context, confidence rooted in self-perceived competence may coexist with limitations in predictive processing, particularly in situations requiring early interpretation of other road users' intentions. National crash analyses show that young riders on light motorcycles are heavily overrepresented in run-off-road crashes and conflicts involving crossing or opposing traffic, precisely those situations where anticipatory skills and cooperative interaction are critical (NPRA, 2025). This suggests that the challenges observed in the interviews are not merely subjective perceptions but are reflected in real-world crash patterns.

The findings further point to a potential misalignment between educational intentions and functional outcomes. While the A1 curriculum explicitly addresses self-reflection, awareness of personal limitations, and the consequences of risky behaviour (NPRA, 2016), the interviews indicate that reflective processes may be oriented more towards confirming competence than critically evaluating it. This is consistent with broader research showing that young and inexperienced riders often exhibit high perceived control before sufficient experience has been accumulated to calibrate confidence against complex and ambiguous traffic situations (Høye, 2017; Høye et al., 2016). Within the GDE perspective, such miscalibration may undermine the intended progression from technical mastery to adaptive, context-sensitive riding behaviour.

Importantly, the combination of strong self-confidence and limited trust in other road users may help explain why young A1 riders remain disproportionately involved in severe crashes despite comprehensive training. If risk is primarily attributed to the actions of others while confidence in one's own abilities remains largely unquestioned, opportunities for effective self-regulation may be reduced. This has direct implications for hazard anticipation, as anticipating danger often requires if other road users may act unpredictably or incorrectly, and adjusting one's own behaviour accordingly (Sagberg et al., 2020).

Taken together, these findings underscore the need to further strengthen educational approaches that explicitly address the calibration of self-confidence and the development of predictive, interaction-oriented riding strategies. Rather than reinforcing individual competence alone, training may benefit from a stronger emphasis on uncertainty, fallibility, and the inherent limits of personal control in real traffic environments, consistent with the holistic intentions of the GDE framework (Peräaho et al., 2003; E. Keskinen et al., 2010). This is particularly salient given the exceptionally high-risk levels documented for young A1 riders, where the risk of being killed or seriously injured per kilometers travelled far exceeds that of car drivers (NPRA, 2025). The findings therefore lend empirical support to arguments for both pedagogical refinement and broader regulatory measures aimed at reducing exposure during the most vulnerable phase of rider development.

5.2. *Predominantly training-driven tactical choices with limited situational adaptation*

The finding that A1 riders' behaviour in curves is predominantly shaped by rule-based strategies acquired during formal training reflects both the strengths and limitations of a highly structured educational system. The Norwegian A1 curriculum provides explicit and detailed guidance on road positioning, speed choice, and control in curves, and these principles are directly operationalized in the assessment criteria for the practical riding test (NPRA, 2016). The interviews indicate that participants have strongly internalized these instructional heuristics,

such as choosing the "straightest possible line" and maintaining stable speed, suggesting that formal education successfully establishes a shared tactical framework for curve negotiation.

From the perspective of the GDE framework, this internalization aligns with the intended progression from basic operational control towards tactically informed riding behaviour (E. Keskinen, 1996; Peräaho, Keskinen, & Hatakka, 2003). Rule-based strategies appear to provide novice riders with cognitively efficient tools for managing complex maneuvers, reducing workload and supporting early skill acquisition. In this sense, the findings demonstrate that the curriculum achieves its immediate objective of equipping young riders with standardized procedures for handling one of the most safety-critical riding contexts.

Interviews reveal notable limitations in riders' ability to adapt these strategies to situational variability. Participants struggled to articulate how tactical choices were recalibrated in response to changing perceptual cues such as sight distance, road surface quality, or the behaviour of other road users. This suggests that tactical competence may remain largely procedural, with limited dynamic coupling between perceptual input and moment-to-moment decision-making. Within the GDE perspective, such a pattern points to a weak integration between perceptual-operational processes and tactical control, undermining the adaptive function that tactical strategies are intended to serve (Christ et al., 1999; E. Keskinen et al., 2010).

This limitation becomes particularly salient when considered alongside national and international crash data. Curve-related crashes remain a dominant crash type for motorcyclists, and loss of control in curves is frequently associated with inappropriate speed, delayed braking, or insufficient adaptation to road geometry and surface conditions (Høye, 2017; Sagberg et al., 2020). For young A1 riders, these crash patterns are especially pronounced, with run-off-road crashes constituting a substantial proportion of serious and fatal injuries (NPRA, 2025). The present findings suggest that while training-derived rules provide a necessary foundation, they may offer only partial protection if riders lack the perceptual and cognitive resources required to adjust these rules under dynamic and uncertain conditions.

The reliance on simplified heuristics may also be understood as a function of limited riding experience. For novice riders, procedural rules serve an important scaffolding function, enabling them to manage complex tasks before more nuanced judgement has developed. Differences between inexperienced and experienced riders in how they describe their own behaviour are also identified in the research report by Wigum et al. (2025), which shows that less experienced riders tend to emphasise rule compliance and self-perceived caution, while more experienced riders describe their behaviour in terms of situational adaption, anticipation, and flexible action selection. However, without deliberate educational progression toward context-sensitive interpretation, such heuristics risk becoming rigid. Successful navigation of routine curves may be interpreted by riders as confirmation of competence, potentially masking deficits in hazard anticipation and situational reading. This interpretation aligns with previous research indicating that young riders often demonstrate high perceived competence despite objectively elevated crash risk, particularly in demanding environments (Høye et al., 2016).

From an educational standpoint, these findings also resonate with the content and objectives of motorcycle driving teacher education in Norway. The education of driving teachers for motorcycle license classes explicitly emphasizes strategic and tactical decision-making as integral components of rider competence, alongside technical vehicle control. By focusing on anticipatory strategies, situational reading, and reflective judgement, driving teacher education aims to equip instructors with the pedagogical competence required to support young riders in developing adaptive riding behaviour in complex traffic environments. In this sense, driving teachers function as a critical link between curriculum intentions and riders' actual behaviour in traffic, and their professional judgement plays a key role in how rule-based strategies are contextualized and translated into practice (Nord University, 2025).

From an educational standpoint, these findings highlight a critical distinction between meeting curriculum-defined performance criteria and developing adaptive riding competence. While the A1 curriculum explicitly addresses tactical elements of curve riding (NPRA, 2016), the interviews suggest that greater emphasis may be needed on how and when established rules should be modified or overridden. Pedagogical approaches that foreground visual strategies, early information pickup, and anticipatory control may help bridge the gap between formal instruction and real-world demands, consistent with the holistic intentions of the GDE framework (Peräaho et al., 2003; E. Keskinen et al., 2010).

Reflective methods, including guided debriefing supported by video, may be particularly well suited to supporting this transition. By making perceptual processes and timing decisions explicit, such methods may facilitate the transformation of procedural knowledge into flexible, context-sensitive tactical competence. Given the disproportionate crash risk associated with curve riding among young A1 riders, explicitly addressing this gap in rider education appears essential for reducing loss-of-control crashes during the most vulnerable phase of rider development (NPRA, 2025).

5.3. *Reactive rather than predictive riding behaviour*

The predominately reactive use of braking in curves described by participants highlights a critical vulnerability in the operational control of young A1 riders. Although braking was frequently perceived as

stabilizing or corrective, its role was largely framed as a response to unexpected or undesirable events rather than as an integrated element of proactive riding strategy. This pattern suggests that while riders possess basic operational competence, anticipatory control remains underdeveloped. Within the broader GDE framework, safe riding is contingent not only on the execution of control actions, but on the ability to anticipate and prepare for potential hazards through timely and informed interventions (E. Keskinen, 1996; Peräaho, Keskinen, & Hatakka, 2003).

The interviews further indicate that avoidance of surface hazards, such as potholes and road surface irregularities, was typically described as isolated corrective actions rather than as part of a continuous process of information gathering and predictive assessment. This fragmented approach to hazard management suggests limitations in how perceptual input is integrated into ongoing control decisions. Previous research has emphasized that insufficient information acquisition and delayed anticipation are central contributing factors in many serious motorcycle crashes, particularly in situations requiring rapid adaptation under time pressure. The present findings indicate that such mechanisms may be operative even among riders who perceive themselves as risk-aware and technically competent.

This reactive orientation becomes especially consequential when considered alongside national crash data for light motorcycles. Run-off-road crashes and loss-of-control events remain dominant crash types for young A1 riders, often occurring in situations where early speed adjustment and preparatory braking could mitigate severity or prevent the crash altogether (Høye, 2017; NPRA, 2025). When braking is primarily employed as a last-resort corrective measure, the temporal margin available for safe recovery is reduced, increasing the likelihood of instability, excessive lean angle, or roadway departure.

The findings also point to a disconnect between operational control and higher-level decision-making processes. While the A1 curriculum emphasizes braking techniques and vehicle handling as foundational skills (NPRA, 2016), the interviews suggest that these skills are not consistently embedded within a broader tactical or strategic riding logic. Within the GDE perspective, operational actions are intended to be guided by higher-level anticipatory processes, where speed choice, positioning, and control inputs are continuously adjusted in response to perceived and predicted demands (Christ et al., 1999; E. Keskinen et al., 2010). The absence of such integration may help explain why technically adequate riders remain vulnerable in complex or rapidly evolving traffic situations.

From an educational standpoint, these findings reinforce the need to shift emphasis from reactive control to anticipatory riding strategies. Training approaches that explicitly link braking behaviour to early information pickup, visual scanning, and hazard prediction may strengthen the coupling between perception and action. In this regard, methods that make riders' perceptual and temporal decision processes visible, such as video-supported reflection, may be particularly effective in supporting learning beyond procedural skill execution.

Overall, the findings underscore that operational proficiency alone is insufficient to ensure safety among young and inexperienced riders. When braking and hazard avoidance are primarily reactive, the margin for error in demanding situations is narrow. Addressing this limitation requires educational interventions that foster anticipatory control and situational foresight, consistent with the holistic intentions of the GDE framework and with the documented crash risk profile of young A1 riders (Peräaho et al., 2003; NPRA, 2025). This pattern is consistent with findings from the Norwegian Accident Investigation Board, which show that serious and fatal crashes involving young A1 riders are frequently characterised by insufficient anticipation and limited ability to cope with sudden changes in road geometry, surface conditions, or the behaviour of other road users (Statens havarikommisjon, 2025). The investigation further documents that strategies taught during rider training were not always applied in the critical moments preceding the crashes, suggesting a gap between learned procedures and real-world execution. Together, these findings indicate that reactive control strategies may provide insufficient safety margins in complex traffic environments and help explain the overrepresentation of young riders in loss-of-control and run-off-road crashes.

6. Conclusion

Taken together, the findings reveal a coherent pattern in how young A1 riders conceptualize and enact riding competence, characterized by strong self-confidence, rule-based tactical behaviour, and predominantly reactive operational control.

At the tactical level, riders demonstrated strong alignment with curriculum-defined rules, especially in curve negotiation. Tactical choices were largely driven by formalized heuristics rather than by continuous situational assessment. While such rule-based strategies support early skill acquisition and assessment performance, they appear insufficiently flexible when riders are confronted with dynamic and non-standard conditions. This reliance on procedural knowledge may obscure deficits in anticipatory judgement and contribute to elevated crash risk in curves, a well-documented high-risk context for motorcyclists.

At the operational level, the predominance of reactive braking further underscores the limited vertical integration across GDE levels. Braking and hazard avoidance were primarily described as corrective responses rather than as proactive elements of a planned riding strategy. This reactive orientation suggests that higher-level safety intentions are not

consistently translated into early speed adaptation, positioning, and control inputs, leaving riders vulnerable when available time and space for corrective action are constrained.

Overall, the findings point to a mismatch between perceived competence and adaptive capability among young A1 riders. While formal training appears effective in shaping attitudes, rules, and basic tactical knowledge, it may insufficiently support the development of predictive, context-sensitive riding strategies that integrate perception, anticipation, and control. Addressing this gap requires educational approaches that explicitly target the translation of higher-level safety goals into adaptive tactical and operational behaviour. Greater emphasis on anticipatory strategies, visual information pickup, and reflective engagement with real-world riding demands may be essential for strengthening vertical coherence within the GDE matrix and, ultimately, for reducing crash risk among young and inexperienced light motorcycle riders.

7. Implications

The findings have important implications for both authorities and the rider training sector with regard to how A1 rider competence is defined, developed, and assessed. While current frameworks appear effective in promoting responsibility and rule compliance, the results suggest a need to place greater emphasis on adaptive and predictive competence.

For authorities, these points to a potential need to strengthen curriculum objectives and assessment criteria related to hazard anticipation, systematic assumption of errors by other road users, and early speed and positioning adjustments in complex traffic situations. A stronger focus on situational adaptability, rather than primarily on rule reproduction, may better align training and testing with known crash mechanisms among novice riders.

For the rider training sector, the findings highlight the importance of pedagogical approaches that move beyond rule-based instruction toward context-sensitive judgement. Greater emphasis on visual strategies, planning horizons, and interaction with other road users, combined with structured reflection supported by video feedback, may help riders translate safety intentions into proactive riding behaviour.

Overall, the results underline the need for stronger vertical integration within the GDE matrix. Aligning regulatory frameworks, assessment practices, and instructional methods with evidence-based insights into novice rider behaviour may contribute to more adaptive riding competence and reduced crash risk among young A1 riders.

References

Eggebø, H. (2020). *Collective qualitative analysis*. *Norsk sosiologisk tidsskrift, 4*(2), 106–122. https://doi.org/10.18261/issn.2535-2512-2020-02-03

Høye, A., Vaa, T. & Hesjevoll, I.S. (2016). *Temaanalyse av dødsulykker på motorsykkel 2005-2014. Transportøkonomisk institutt.* https://www.toi.no/getfile.php?mmfileid=45793

Iversen, T & Njå, O. (2022). (*Temaanalyse av alvorlige ulykker på ATV, moped og motorsykkel 2015-2020.* Universitetet i Stavanger). Thematic Analysis of Serious Accidents Involving ATVs, Mopeds, and Motorcycles 2015-2020. University of Stavanger.

Keskinen, E., M. Peräaho and S. Laapotti (2010.)GDE-5PRO and GDE-5SOC: Goals for driver education in a wider context–professional and private drivers in their environment. Unveröffentlichtes Manuskript, Universität Turku, Finland.

McKnight, A. J. & Adams, B. B. (1970). Driver Education Task Analysis. Volume II: Task Analysis Methods. Final Report. Alexandria VA: Human Resources Research Organization

Michon, J. (1985). A critical view of driver behavior models. I L. S. Evans (Red.), Human behavior and traffic safety. New York: Plenum Press.

Nord University. (2025). *Motorcycle: Special education for traffic instructors*. Retrieved January 9, 2025, from https://www.nord.no/studier/motorsykkel-spesialutdanning-for-trafikklaerere

Norwegian Public Road Administration. (2016). Curriculum for category A1.

Norwegian Public Roads Administration. (2025). *Consequences of age requirements for light motorcycles: Potential road safety effects and other impacts of age limits for A1 motorcycles* (NPRA Report No. 1086). Statens vegvesen. 081025 SVV rapport 1086 - Konsekvenser av alderskrav for legg motorsykkel.pdf

Peräaho, M., Keskinen, E. & Hatakka, M. (2003). Driver Competence in a Hierachical Perspective; Implications for Driver Education. University of Turku, Traffic Research.

Statens havarikommisjon. (2025). *Delrapport 1 – Temaundersøkelse om ulykker med ungdom på lett motorsykkel* (Rapport Vei 2025/04). Statens havarikommisjon.

Wold, T., & Wigum, J. P. (2024). *Traffic culture, risks and driving behaviour among adolescent ATV/UTV-users in Norway*. Paper presented at the International Co-operation on Theories and Concepts in Traffic Safety (ICTCT) 2024 Conference, The Hague, The Netherlands.

Wigum, J. P., Bogfjellmo, P. H., Bromstad, S. M., Gela, Z., Roche-Cerasi, I., Moe, D., Tangrand, K., & Johansen, B. M. (2025). *MC-føreres handlingsvalg og blikkbruk for sikker kjøring* (FoU-rapport 116). Nord universitet. https://hdl.handle.net/11250/3171347