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RESEARCH ARTICLE

RESPONSIBLE ADOPTION OF APPLIED ARTIFICIAL INTELLIGENCE IN SAUDI SECONDARY EDUCATION: OPPORTUNITIES, GOVERNANCE AND EDUCATIONAL OUTCOMES TOWARD VISION 2030

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Abstract

This review aims to provide an evidence-based framework for the responsible integration of applied Artificial Intelligence into Saudi secondary education. This framework will link classroom opportunities to governance protections and tangible educational outcomes aligned to Vision 2030. Approach to design/methodology A structured integrative review was conducted, synthesizing peer-reviewed research, evidence from Saudi Arabia and official policy documents, published predominantly from 2020 to August 2026. The review followed the PRISMA guidelines but was not conducted as a meta-analysis since the body of evidence includes empirical studies, conceptual papers, competency frameworks, and regulatory documents. Results: Applied AI has the potential to enhance formative feedback, provide differentiated support, aid teacher planning, improve accessibility, promote student self-regulation, and enable data-driven interventions. Yet the educational value of such AI depends on human supervision, teacher capability, data minimisation, privacy, explainability, fairness, age appropriate safeguards, academic integrity, and ongoing evaluation. Although Saudi Arabia is entering this stage with considerable national momentum—due to initiatives aimed at teacher development and the existence of a national AI curriculum—the literature on secondary education is still less extensive than that available at the higher education level. Contribution/originality: The review changes the focus from whether schools should use AI to how they can do so responsibly. It proposes a five-stage governance framework and stepwise implementation process, where pedagogical necessity, lawful handling of data, model assurance, human accountability, and evidence of outcomes determine whether an AI application should be piloted, scaled up, redesigned, or discontinued.

Introduction:-

Artificial intelligence is now going from being a technology for specialists to being used in everyday instructional settings. As a result, the relevant literature does not any longer view the use of artificial intelligence in education as consisting of a single application; rather it is seen as a range of data-oriented and generative capabilities which can

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help with teaching, learning, assessment, administration, and decision making (Hwang et al., 2020; Ouyang and Jiao, 2021). The importance of this distinction in secondary education rests in the fact that the same system might be pedagogically useful for one task but inappropriate for another. Thus the risk level of a chatbot employed to produce practice questions is different from that of an algorithm used to classify a student as being academically at risk.
Saudi Arabia offers a particularly important case in which to look at this transition, since Vision 2030 and the Human Capability Development Program have incorporated digital capability, future skills, educational quality, and labour-market readiness into their national transformation strategy (Saudi Vision 2030, 2021). This strategy has now been put into practice in schools. In order to do this, Saudi authorities have introduced an artificial-intelligence curriculum for all public education from the 2025–2026 academic year after first offering an introductory AI course to third-year high-school students (Saudi Press Agency, 2025). Furthermore, national initiatives have trained more than 11,000 teachers in data and AI and have given a large number of students exposure to AI concepts via school programmes (Saudi Press Agency, 2024). As a result, responsible AI is no longer only a theoretical policy concern; it is now included in curriculum design, teacher training, and classroom activities.

The Saudi review of higher education offers useful background information on the ecosystem. Alotaibi and Alshehri (2023) noted an increasing interest in learning outcomes that are based on AI, together with a requirement for teachers to have technological skills and for there to be adequate infrastructure aligned with Vision 2030. The second of the studies, Albahli (2025), shows the educational potential of predictive modelling and explainable AI, while at the same time pointing out the compromise that must be made between predictive accuracy, interpretability, computing requirements, privacy, and bias. Although both studies are useful as reference points, neither of them can be applied to secondary schools; it is therefore necessary to develop a more explicitly child-centred and governance-oriented approach for secondaryeducation.

Research on an international scale supports this requirement. While AI can customise learning, provide feedback, and aid teachers in making decisions, there is still the risk that it will reinforce bias, hide the grounds of its decisions, promote excessive dependence, reveal personal data, or undermine genuine assessment (Holmes et al., 2022; Baker and Hawn, 2022; Akgun and Greenhow, 2022). Furthermore, generative AI brings an additional issue since its fluent output may include factual errors, made-up references, stereotypical content, or reasoning that students cannot easily check (Kasneci et al., 2023; Lo, 2023). Responsible adoption is therefore not the same as either banning dangerous tools or pushing innovation without any limits; it entails setting up conditions where the educational benefits can be reasonably expected, potential harms are anticipated, responsibility is clear, and evidence is collected before widespread use.

The main point of this review is that applied AI in Saudi secondary schools should be regarded as an educational intervention which is properly governed, rather than as a software purchase. This approach is in line with the principles set out by the Saudi Data and AI Authority concerning fairness, privacy and security, reliability and safety, transparency and explainability, and accountability (SDAIA, 2023), as well as with the national AI Adoption Framework (SDAIA, 2024). Moreover, it is in agreement with the positions taken by UNESCO and UNICEF that see human agency, rights, inclusion, and age-appropriate preparation as essential prerequisites for trustworthy educational AI (UNESCO, 2021; UNICEF, 2021).

Aim, Objectives and Review Questions:-
The objective of this study is to create a framework for the responsible introduction of applied AI into Saudi secondary education which simultaneously maximises educational value, ensures governance safeguards, and achieves the human-capability objectives of Vision 2030. Unlike other studies that mainly focus on attitudes towards adoption, patterns of university publications, or the performance of predictive systems, this one regard governance and educational effectiveness as part of the same design problem.

The review is based on four objectives. The first is to link pragmatic applications of AI in secondary schools with the foreseen outcomes for students, teachers, and the schools themselves. The second consists of identifying the governance requirements relating to privacy, fairness, explainability, academic integrity, child rights, human monitoring, and accountability. The third looks at Saudi Arabia's readiness and the factors that would enable implementation, such as the capability of teachers, the readiness of students, changes to the curriculum, and the nation's AI initiatives. The fourth involves recommending a step-by-step approach to the adoption and evaluation of AI until 2030.

Review Methodology:-

A structured integrative review was chosen since the research question involves a diverse range of evidence. The field includes experimental and survey studies, conceptual models, systematic reviews, regulatory principles, national strategies, competency frameworks, and implementation guidance. The review adhered to transparent stages for identification, screening, appraisal, and synthesis, employing an integrative approach rather than one that aggregates effect sizes. This method is also in line with the review mentioned, which used PRISMA 2020 to organise the selection of the literature; however, the current study concentrates on a narrower educational level and expands the governance area (Alotaibi and Alshehri, 2023).

The evidence base was put together using the two MDPI papers as starting points, by carrying out targeted searches of scholarly and publisher databases accessible via indexed web records, and by consulting authoritative Saudi and international policy repositories. The searches focused on material dated from 2020 up to August 2026. For important conceptual studies, backward citation checking was carried out. Official documents were kept in place if they defined applicable law, national programmes, competency requirements, or recognised child-centred safeguards.

To be included, one had to make a clear contribution to at least one of the four analytic areas—educational opportunity, implementation readiness, responsible governance, or outcome evaluation. International research was included if it provided transferable theory, risk evidence, or design principles.

The quality assessment was interpretative and based on whether it was suitable for the purpose in question. When looking at empirical studies we took into account the context, the sample, the method, how the outcomes were defined, and the limitations regarding transferability. For reviews we considered the transparency of the search and the extent of conceptual coverage. The governance documents were assessed in terms of their legitimacy and pertinence. Special care was taken when it came to studies from the field of higher education. In a similar way, perception surveys were seen as reflecting readiness or acceptability rather than as proof of learning gains.

The analytic corpus that was produced consisted of 30 references and was organised thematically. The coding process started deductively by referring to the review questions and also proceeded inductively by identifying repeated topics in the sources. The opportunity-related codes were personalisation, feedback, teacher augmentation, prediction, accessibility, and AI literacy. For the governance aspect, the codes were purpose limitation, minimisation, fairness, interpretability, safety, accountability, academic integrity, procurement, and child protection. The outcome codes differentiated among short-term process indicators and those relating to learning, equity, well-being, teachers, and system-level outcomes. The synthesis then converted the themes into an evidence-to-decision matrix and a staged maturity pathway. Since the review does not involve calculating pooled effects, it presents its claims as evidence-informed propositions and governance recommendations rather than as causal estimates.

Evidence Landscape and Saudi Context:-

The current level of research among schools indicates that the drive for introducing AI into Saudi secondary education is actually less than the policy position suggests. The official policy position is clear in that the Human Capability Development Program connects education reform with future skills and lifelong capabilities, and the new AI curriculum has brought AI literacy into the general education system (Saudi Vision 2030, 2021; Saudi Press Agency, 2025). UNESCO's framework for student competencies also offers a useful point of comparison by organising AI capabilities around a human-centered approach, ethics, techniques and applications, and system design, progressing from understanding to application and then to creation (Miao et al., 2024). The policy opportunity is thus to link the study of AI in the curriculum with its responsible use in a variety of subjects rather than treating these two areas as separate endeavours.

Readiness, however, differs at various levels. A survey carried out among 427 secondary school teachers in Riyadh showed the importance of prerequisites concerning the students, the teachers, the learning environment, and the subject matter (Alkhuzaim et al., 2024). Research involving intervention in Saudi Arabia has now started to go beyond relying on perception data. Alghamdi et al. (2026) evaluated a GenAI chatbot designed to support the secondary school physics curriculum and discovered preliminary evidence that it led to greater pre-class preparation and more active engagement, but cautions against making causal claims. More up-to-date findings show that student readiness is not simply a question of having access to a device. Al-Mutairi et al. (2026) found that moderate readiness was influenced by social, family, and personal factors such as peer support, parental guidance, time

management, attention, and self-regulation. These results show that an implementation model should involve technical access, pedagogical routines, family communication, and learner agency all developing together.

It is also very important to have capable teachers. The national programmes in Saudi Arabia have made significant investments in increasing teachers' awareness of AI and in their technical development (Saudi Press Agency, 2024). Yet, international evidence warns that competence should not be limited to just using operational tools. UNESCO's teacher framework includes a human-centered approach, AI ethics, the basic principles and applications of AI, AI pedagogy, and the use of AI for professional development (Miao and Cukurova, 2024). Likewise, Long and Magerko (2020) and Ng et al. (2021)have also defined AI literacy as comprising knowledge, critical evaluation skills, communication skills, and ethical awareness.

A further issue concerning readiness is that of institutional data and governance. Since predictive and adaptive systems need detailed information on students' behaviour and academic performance, Albahli (2025) stresses the importance of explainability and data quality in the area of educational prediction, since accurate predictions by themselves are not sufficient to justify significant decisions regarding schools. The Saudi institutions function under the Personal Data Protection Law and SDAIA's AI ethics principles require respect for privacy and security, fairness, transparency, reliability and accountability (Saudi Arabia, 2021; SDAIA, 2023). Even greater care must be taken when applying these principles in schools since the data concerned may involve minors. UNICEF's child-centred guidance emphasizes development and well-being, inclusion, non-discrimination, privacy, safety, explainability, accountability and preparation for an AI-shaped future (UNICEF, 2021). Readiness must therefore be assessed in terms of both governance capacity and digital capacity.

Opportunity Domains in Secondary Education:-

The best argument for the use of AI in secondary education does not lie in complete automation but rather in the targeted enhancement of teaching and learning alike. One example of this is personalized practice. Hwang et al. (2020) regard personalized guidance and feedback as key roles for AI, and Ouyang and Jiao (2021) claim that the field is moving from AI-directed learning to AI-supported and AI-empowered approaches in which learner autonomy grows. For Saudi schools, this suggests a preference for systems that enable students to take an active role, allow teachers to disregard the recommendations, and show the reasons for recommending a particular task or resource.

Formative feedback offers a second chance. AI can give at once low-risk responses to practice exercises, identify misconceptions, summarise typical errors, or assist teachers in preparing tailored follow-up activities. The advantage lies in speed and the wide range of coverage, not in replacing the teacher's judgment. Generative systems are especially helpful for creating different versions of questions, producing worked examples, offering vocabulary support, or drafting feedback, but their outputs have to be checked since plausibility does not mean correctness (Kasneci et al., 2023; Lo, 2023). In a responsible approach, the teacher remains accountable for curricular accuracy and students are asked to compare, criticise or improve the AI's output rather than just accept it.

Even before sophisticated student-facing systems have been put into place, teacher augmentation could bring about short-term benefits. AI can help with lesson planning, adapting resources, drafting rubrics, producing administrative summaries, and analysing non-sensitive classroom trends. This in turn makes time available for instructional tasks, but efficiency should not be the only aim. Farrokhnia et al. (2024) indicate that generative AI has a number of interlinked strengths, weaknesses, opportunities, and threats. Time savings within education are only valuable if they lead to better preparation, higher quality feedback, or improved interaction between teachers and students. Schools should therefore assess whether AI-assisted planning has improved instructional quality rather than simply keeping track of how many teachers have accounts.

There is also a fourth chance provided by learning analytics and early-support systems. By examining data on attendance, assessment patterns, assignment completion, and pupil engagement, it is possible to spot the students who might require extra help. Albahli (2025) shows the wider potential of machine-learning models and explainable AI in identifying predictors of academic outcomes. Khosravi et al. (2022)say that explainable AI is important since educational stakeholders need understandable reasons, not unclear scores. In the case of secondary schools, predictions should encourage supportive inquiry and must never function as an automatic label or punishment. A risk score should result in a teacher reviewing the situation, lead to a discussion in the context of the individual student's circumstances, and provide an opportunity for correction. Schools must forbid making high-stakes decisions merely on the basis of automated inference.

Accessibility and support for different languages are also a bright field. Features such as speech recognition, text simplification, translation, captioning, and multimodal generation could help learners who require alternative ways of understanding or extra practice. However, just because a tool is available doesn't mean that it promotes inclusion. As Baker and Hawn (2022) show, algorithmic prejudice can get inside educational systems via the data used, the design decisions, the labels assigned, and the conditions under which the tools are deployed. For accessibility to be considered responsible, it is necessary to carry out testing on different subgroups, take user feedback into account, and provide alternatives whenever an AI output is inappropriate. In the case of Saudi Arabia, the validation process should specifically include an evaluation of the system's performance in Arabic and of its agreement with the requirements of the national curriculum, rather than assuming that general-purpose tools work equally well in all situations.

AI is also an educational topic. In order to gain a proper understanding, students should study data, models, uncertainty, generative systems, verification, bias, intellectual responsibility and the social effects of automation. Rather than just becoming familiar with them, Long and Magerko (2020) and Ng et al. (2021) regard AI literacy as comprising a number of competencies. Miao et al. (2024) build on this idea by advocating responsible student involvement as users and co-creators. The national AI curriculum in Saudi Arabia provides a platform for this kind of change.

Table 1. Evidence-to-decision matrix for applied AI in Saudi secondary education

Use case	Intended value	Principal risk	Minimum governance control	Outcome indicator
Personalised practice	Differentiated pace, hints and practice	Over-reliance; weak curriculum fit	Teacher-selected scope; override; curriculum validation	Independent post-task mastery
Generative feedback	Faster formative feedback and exemplars	Hallucination; integrity; deskilling	Teacher verification; disclosure rules; source checking	Feedback uptake and unaided performance
Teacher planning	Resource adaptation and preparation efficiency	Unverified content; hidden data sharing	No sensitive data; teacher accountability; approved tools	Time saved plus instructional quality
Learning analytics	Earlier identification of support needs	Bias; opaque labels; surveillance	Purpose limitation; explainability; human review; appeal	Timeliness and fairness of support
Accessibility/language support	Alternative representations and participation	Unequal model performance	Accessibility testing; Arabic validation; fallback route	Access, error rates and learner experience
AI literacy	Critical, ethical and creative AI capability	Superficial tool familiarity	Curriculum progression; authentic assessment	Verify, disclose, critique and create responsibly

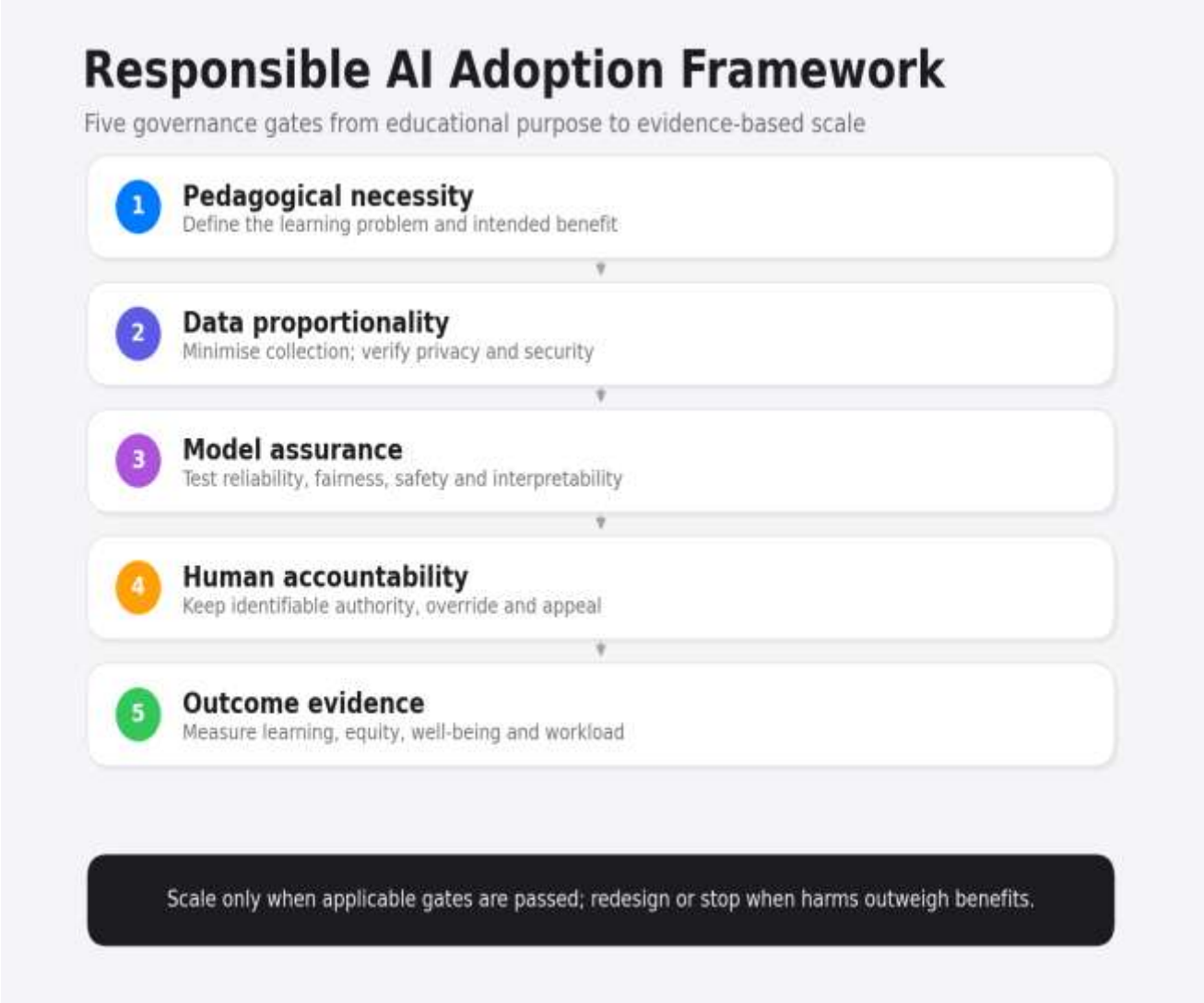

Figure 1. Responsible AI adoption framework for secondary-school use cases

Governance for Responsible Adoption:-

The idea of accountability in the process of introducing new methods is that governance must be built into the teaching approach right from the start, not introduced at a later date. The first question to ask should be whether or not the use of the tool is actually necessary from a educational point of view. Chiu et al. (2023) have demonstrated that the use of AI in education leads to similar opportunities and challenges in the fields of teaching, learning and administration, and therefore decisions regarding adoption have to be based on each specific use case. Simply stating that a tool is 'AI-powered' is not sufficient as an educational justification. Schools should choose the least intrusive technology that fulfils the stated need and should keep a non-AI option if this contributes to promoting inclusion or continuity.

The second aspect concerns fair and reasonable data practices. The personal data protection law in Saudi Arabia specifies the obligations relating to the processing of personal data, and the AI principles issued by SDAIA stress the importance of protecting privacy and ensuring security (Saudi Arabia, 2021; SDAIA, 2023). Particular care must be taken in the case of minors. When a vocabulary tutor can function without the need for behavioural profiling, the school has few grounds for collecting a large quantity of behavioural data. A written privacy and risk assessment must be prepared prior to any pilot deployment in sensitive or consequential situations.

The gate third one concerns model assurance and involves reliability, fairness, safety, and explainability. Accuracy has to be checked on the target population and task, not on the vendor's claims or on benchmarks that have nothing

to do with the task. Bias may result from historical data, from the method of taking samples, from proxies, from the labels, from the objectives employed for optimization, or from the model acting in an inconsistent way (Baker and Hawn, 2022). It therefore follows that fairness monitoring should compare relevant groups of students and different school situations without avoiding the collection of sensitive attributes unless there is a particular need to do so. Khosravi et al. (2022) note that explainability in the field of education is just as much a problem for the people concerned as it is a technical one; an explanation is only of any value if it leads to responsible action.

The fourth point relates to human accountability. School AI should be designed so that there are clearly identified human decision-makers. Instead of treating ethics as a separate technical feature, Holmes et al. (2022) suggest the use of one ethical framework for the entire community. Akgun and Greenhow (2022) also point out the ethical problems that arise in K-12 settings and stress the need to consider issues such as privacy, autonomy, surveillance, bias, and responsibility. In the case of secondary education in Saudi Arabia, teachers and school leaders must keep their authority over decisions regarding teaching and student support. Students should be made aware every time they are interacting with AI or when AI makes a significant contribution to a decision. There should be a way by which the results arrived at can be challenged, corrected or appealed. Human monitoring only becomes necessary if the person carrying out the review has both the time and the appropriate knowledge and authority to reject the system's recommendation.

The fifth gate relates to outcomes and proportionality. A tool should not be adopted simply because users prefer it or because it is technically stable. The pilot has to determine whether the desired benefit has been achieved without causing unacceptable effects on equity, well-being, workload, integrity, or privacy. This is especially true in the case of generative AI. Kasneci et al. (2023) point out the educational opportunities as well as the risks associated with erroneous output, bias, misuse, and changes to assessment. Lo (2023) also observes that the evidence base concerning ChatGPT expanded quickly at the start and depended largely on conceptual and early empirical studies. Schools must therefore keep experimentation separate from institutionalisation and demand stronger evidence as the stakes and the scale rise.

Academic integrity should have its own particular operational policy since a general prohibition might cause people to use AI illegally, while failing to impose any restrictions would damage the evidence of what the students have really learned. A more reliable method would be to specify for each task which uses of AI are allowed, which are allowed on certain conditions and which are prohibited. When setting up assessments, more attention should be given to the process, the specific circumstances, the criticism and the actual performance. Students should be taught about AI and integrity combined in such a way that revealing the use of AI is seen as a matter of scholarly responsibility rather than as a means of surveillance.

Procurement is also a aspect of governance which is often overlooked in discussions regarding education. In its AI Adoption Framework (2024), SDAIA incorporates responsible use, human skills, data, technology, and organizational enablement as part of the overall adoption process. When evaluating vendors it is necessary to adopt a flexible approach; in the case of higher-risk applications they can be sent over for examination by the district or the ministry. Incidents must be documented and investigated, including those relating to harmful outputs, privacy breaches, systematic faults, or issues with integrity. As stated in UNESCO’s Recommendation on the Ethics of Artificial Intelligence, human rights, fairness, transparency, accountability and continuous governance throughout the AI life cycle should all be maintained (UNESCO, 2021). UNESCO’s guidance on generative AI also stresses human-centred regulation, data privacy, age-appropriate use and capacity building (UNESCO, 2023). These principles form the foundation of a governance approach which learns from real-world experience rather than seeing approval as a one-off event.

Educational Outcomes and Evaluation Logic:-

Specify the instructional outcomes before carrying out the implementation and take measurements at a number of different levels. Although these measures do not demonstrate the educational impact, they show whether the pilot is stable enough for outcome evaluation.The second level is that of learning, and it should involve the collection of baseline and comparative data where this is possible. For instance, a personalised practice tool should be assessed according to the user's subsequent independent performance and not on the amount of activity carried out within the tool. This method prevents mistaking engagement for mastery. The learner-agency perspective put forward by Ouyang and Jiao (2021) is useful in this context since the aim should not be to create a dependence on AI but rather to enhance the individual's ability to learn, reflect and act.

This stage is that of equity and inclusion; although the average level of improvement might mask uneven benefits or concentrated harm. As the literature on algorithmic unfairness makes clear (Baker and Hawn, 2022), it is necessary to carry out such a breakdown. When assessing equity it is also important to take into account qualitative evidence from students who have difficulty using the interface, who lack support at home, or who prefer not to use AI. Al-Mutairi et al. (2026) point out that readiness is to some extent a social and familial matter, and therefore one cannot conclude that a student will be successful in school simply on the basis of having access to a device.

The fourth level is about student development and well-being. Although AI can help to reduce frustration by delivering timely support, over-automation might have a negative effect on productive struggle, persistence, attention or interpersonal learning. According to UNICEF (2021), child development and well-being should be at the heart of child-centred AI. It follows that secondary schools should keep an eye on students' confidence, their ability to regulate themselves, the amount of cognitive effort they put in, their sense of agency, and their perceptions regarding surveillance or pressure. The measures taken can include the use of short, validated surveys, focus groups, observations and teacher judgement. A system which improves test results but does so at the expense of autonomy or well-being must not be regarded as a genuine success.

The fifth level focuses on teachers and the school system, and among the relevant outcomes are preparation time, the amount of work involved in giving feedback, the quality of instructional decisions, professional confidence, the degree of collaboration, and trust in the way the system is governed. Teacher capacity should not be seen simply as a factor involved in implementation; rather it is an outcome of responsible adoption. According to the UNESCO teacher framework, there should be progress towards the informed, ethical, and pedagogically purposeful use of teaching methods (Miao and Cukurova, 2024). At the system level, authorities are able to monitor procurement efficiency, the frequency of incidents, equity across schools, the cost per successful intervention, and the extent to which local evidence is used to revise policy.

The balanced scorecard makes it so that neither "accuracy" nor "usage" ends up taking priority in the evaluation process. Artificial intelligence that is put into use should be assessed at the same time with regard to its educational effectiveness, the degree of human agency it involves, fairness, safety, privacy, the workload it places on teachers, and cost. In cases where the evidence is uncertain, the pilots should be reversible. When the benefits are significant but the harms are concentrated, redesign should be chosen rather than scaling up. In instances where a low-stakes tool brings about only a modest benefit together with negligible risk and low cost, proportionate lighter governance may be appropriate. This approach converts responsible adoption into an iterative learning system consisting of definition, piloting, measurement, review, improvement, and only then expansion.

Responsible Adoption Framework toward Vision 2030:-

The synthesis proposes a step-by-step approach to the development of Saudi secondary education up to 2030. The first stage entails preparing the way and setting rules. Schools are required to draw up policies on approved uses, set up AI registers, map out their current data flows, identify activities that carry a high risk, and offer basic professional development for staff. The teachers will learn how to check the outputs, preserve data, redesign assessment methods, and detect bias. Students will be taught about safe prompting, verifying sources, disclosure, privacy, and the limits of the model's authority. Parents will get clear information regarding the systems that are accessible to their children and the ways in which they can raise questions. The main aim at this stage is not to achieve the highest level of adoption but to establish a common understanding of how things work.

In the second stage piloting takes place. Each pilot has an owner with a name, a baseline measure, specified data, a risk assessment, defined success criteria and stop conditions. Routine pilots should not include high-stakes predictions or automated disciplinary decisions unless a more strong legal, technical and evaluative framework has been put in place. The evidence-to-decision matrix listed in this review may be used as a template for choosing controls and metrics.

In stage three, scaling is based on evidence. Applications which satisfy the relevant educational and governance criteria are expanded throughout different subjects or schools, including monitoring for context drift. Scaling should involve version control since the behaviour of the model can change following software updates. Teacher communities of practice should be able to share prompt patterns, assessment designs, failure cases, and local evidence. Central support should keep up the approved procurement clauses, evaluation instruments, incident taxonomies, and the Arabic-language validation protocols. This setup achieves a equilibrium between national consistency and decisions made at the school level.

In stage four there is institutionalisation and ongoing improvement up to the year 2030, with policy being determined by data collected from pilot projects and incidents. Student AI literacy is tested by means of real-life tasks that call for judgement, creation, verification, and moral judgment rather than simply memorising terminology. As Miao et al. (2024) have shown, there is a useful progression from understanding to applying and creating, and UNESCO (2023) stresses that generative AI should continue to be under human control and be governed in an age-appropriate way.

Two design principles apply at every stage: firstly, the level of governance should correspond to the level of risk; secondly, human capability must increase faster than technological dependence. The more important the application of AI, the more important it is that teachers, leaders, and students should be able to challenge it. This is in line with SDAIA's responsible-adoption model, which regards human skills as something that enables the process rather than as an afterthought (SDAIA, 2024).

Vision 2030 alignment should also be assessed in a substantial way, since simple figures showing the number of deployments do not prove that real change has taken place. Useful baseline information on professional development and the conditions for digital teaching at the lower-secondary level in Saudi Arabia is provided by OECD evidence, although the fact that this evidence is based on self-reports means that it has to be interpreted with care (OECD, 2025).

The framework suggested therefore regards 2030 as an objective to be achieved in terms of capability rather than as a deadline for technological development. Because of the forward movement of Saudi Arabia's policy, there is an opportunity to establish responsible practices from the start, before irregular local habits become firmly entrenched. A governance structure grounded in purpose, proportionality, evidence, and accountability can still be of value even if the models and interfaces change.

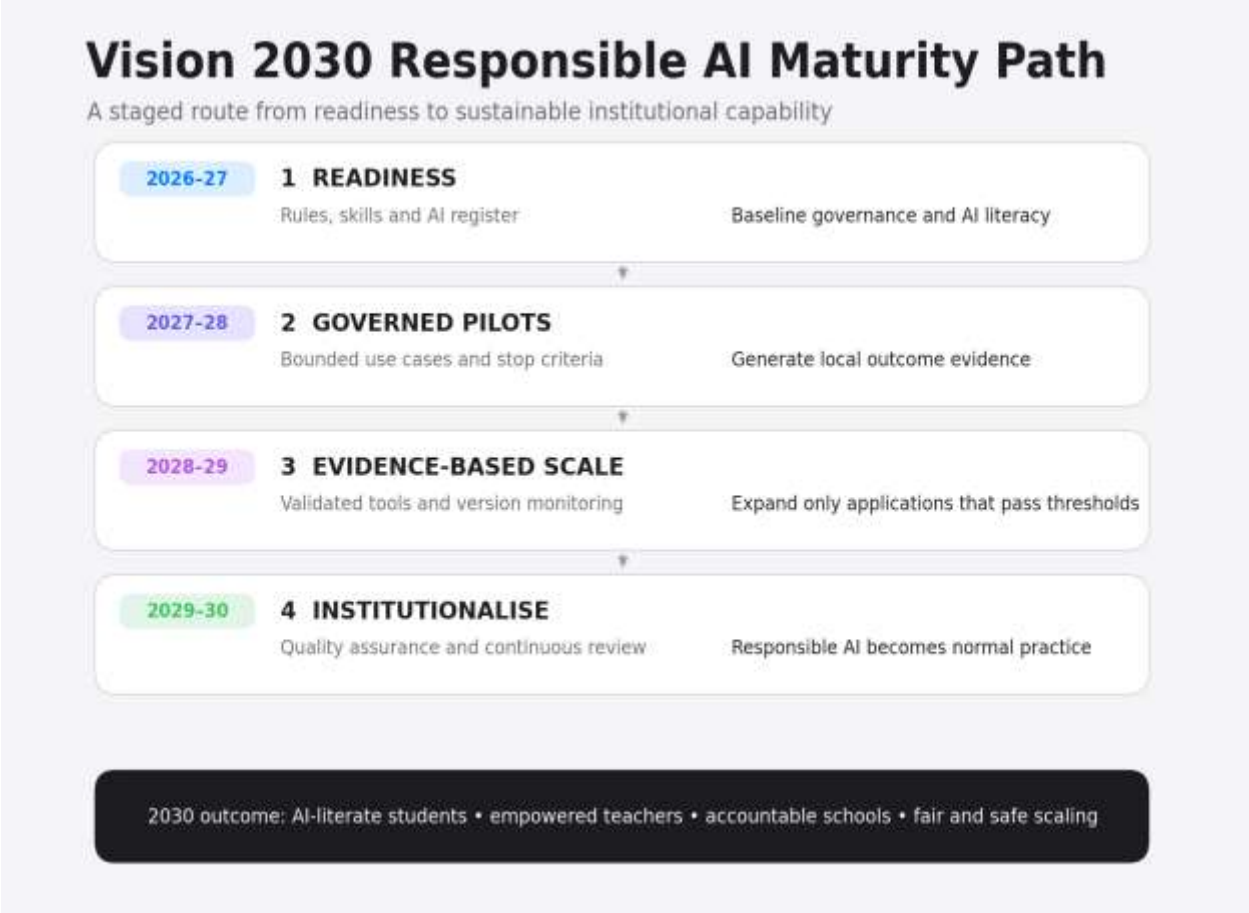

Figure 2. Vision 2030 responsible AI maturity path for Saudi secondary education.

Table 2. Staged implementation roadmap and governance gates toward 2030

Phase	Priority actions	Governance gate	Illustrative indicators	Primary accountability
2026–27: Readiness	Policy; AI register; teacher/student literacy; data mapping	Purpose + lawful data	Training completion; approved-use coverage; baseline incidents	School leaders + authority
2027–28: Governed pilots	Bounded pilots; baseline; stop criteria; parent communication	Model assurance + human oversight	Error/override rates; learning change; complaints	Pilot owner + teachers
2028–29: Evidence-based scale	Scale validated tools; version monitoring; communities of practice	Outcome evidence + equity	Independent mastery; subgroup fairness; workload; cost	Authority + school networks
2029–30: Institutionalise	Embed in QA, curriculum, standards and procurement renewal	Continuous life-cycle review	AI literacy; audit closure; sustained gains; incident trends	Ministry/authority + schools

Discussion, Implications and Limitations:-

The review offers three conclusions to the existing body of literature. Firstly, the evidence points to a move away from technology-centered adoption and towards governance based on specific use cases. Talks of "AI in education" are too wide-ranging to be of any use when it comes to making operational decisions. Since different applications differ in terms of data intensity, reversibility, visibility, and their effect on student rights, the suitable unit of governance should be the particular use case with controls that are proportional to the level of risk. In this way, the usual conflict between innovation and regulation is resolved since low-risk experimentation can take place rapidly while applications with significant consequences are subject to more rigorous evidence and oversight.

Secondly, responsible adoption and educational effectiveness reinforce each other. Although privacy, explainability, teacher supervision, and student autonomy are at times presented as constraints that hinder innovation, in the context of education they generally lead to better implementation quality. A teacher who knows the reason for a recommendation made by a model is in a better position to act on it. A student who understands the limitations of generative output is more likely to check the information and learn from the experience. A system based on minimal and well-governed data is easier to explain and to audit. Governance is therefore an integral part of instructional design and not a separate compliance layer.

Thirdly, there is now a clear need for a great deal more research into the outcomes at the school level. The Saudi review that is attached describes an emerging AI environment in higher education (Alotaibi and Alshehri, 2023), and the present national initiatives show that there is rapid expansion into general education. However, the literature specifically concerning secondary education is still mainly made up of studies on readiness and perceptions rather than of controlled or longitudinal evaluations. Alkhuzaim et al. (2024), Alghamdi et al. (2026), and Al-Mutairi et al. (2026) do provide useful contextual evidence. Yet they are unable to determine which applications enhance learning, for whom, under what conditions, and at what cost. The next stage of research should therefore involve testing actual interventions in the classroom, together with transparent governance measures and an examination of the educational outcomes.

Policymakers could take the SDAIA principles and turn them into specific requirements and reusable templates for use in education. School leaders should ensure that governance is linked with procurement, safeguarding, assessment policy, professional development, and school improvement. Teachers' professional learning should focus on pedagogical judgment and verification rather than on tricks that are specific to particular tools. This kind of reporting would make the evidence base more cumulative and would lower the risk that impressive but context-free demonstrations influence policy.

The review does have some limitations; it is integrative not a registered systematic review and because of the heterogeneity of its corpus it is not possible to calculate pooled effect estimates. The fast pace of change in commercial generative systems means that evidence specific to each tool can quickly become outdated. Although

some of the secondary evidence from Saudi Arabia is recent, it is both geographically limited and based on perceptions. While policy announcements do indicate both the direction and the scale of action, they do not themselves prove educational effectiveness. These limitations underline the review's main recommendation, which is that adoption should continue to be evidence-generating, reversible, and subject to periodic reassessment. This in turn promotes responsible practice in schools and communities and at the same time keeps purpose, human judgment, learner agency, and equity.

Conclusion:-

Artificial intelligence can be used to help out Saudi secondary education, but the extent of its value will depend more on the quality of the decisions made by the institutions than on how innovative they are. The evidence examined in this report indicates that specific applications should be made in the areas of formative feedback, differentiated practice, teacher augmentation, accessibility, learning analytics, and AI literacy.

A model that is responsible should therefore start with the aim of education, use only the data that is necessary, check its reliability and fairness, maintain meaningful human control, and require evidence of the outcomes before it is expanded in scale. These five criteria link the Saudi AI ethics principles with a child-focused approach to education and also offer a practical response to the rapidly changing technology environment since they remain relevant even when specific models are replaced.

Saudi Arabia possesses important enabling factors such as national strategic commitment, growing teacher development, a general-education AI curriculum, and already existing data and AI governance institutions. The focus up to 2030 must be on turning this momentum into local evidence and building up sustainable capabilities. Responsible adoption, here, is not something which hinders educational innovation; rather it is the discipline that ensures innovation becomes credible in an educational sense, socially acceptable, and sustainable.

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