Early Years STEM

What are the issues?

The future of the Moray economy is at risk from 4 challenges relating to skills.

1. The evolution of the skills required by the future jobs market.
2. The continuing challenge in raising STEM attainment levels at both primary and secondary school levels in Moray.
3. The gap in salaries and opportunities between men and women
4. Ensuring that STEM subjects are perceived and are accessible to all.

These challenges are not independent of each other and to enable the economy of Moray to flourish in the future, all must be addressed together.

The UK economy is changing. According to research from the World Economic Forum Assembly and Factory Workers, Accountants and Customer Services Workers are in the top 10 roles which are increasingly redundant. These are to be replaced by Artificial Intelligence and Machine Learning Specialists, Process Automation Specialists and Digital Transformation Specialists.

These changes will not apply to specific regions. With 20% of employment in Moray coming from manufacturing, automation is a high risk to our Moray workforce. Furthermore, the use of financial technology will eliminate the need for whole departments in every company, not only ones operating at the high end of the technological spectrum, and it is clear that the direction of travel in the economy is towards STEM skills.

In order to adapt and benefit from these changes, the Moray workforce must be prepared in advance, which requires challenge 2 to be addressed. Attainment at broad general education and at a senior phase in Moray is lower than the Scottish average. Attainment is a key strategic focus for the authority since young people in Moray leave primary and secondary school with less of the fundamental building blocks for STEM attainment than their peers out with Moray.

While there is evidence of improving trends, it should be noted that in 2018 70% of Moray children achieve the expected levels in numeracy while the national average is 79%. Numeracy is a basic enabler to achieving qualifications in STEM and if children are behind in this by the time they reach secondary school then this makes attainment in line or above the Scottish average ever more challenging.

Also in 2018, this is reflected in the passes achieved at national 5 and Higher. 50% of students obtain 6 passes at national 5 in Moray, nationally this is 57%. 37% of students achieve passes in 4 Highers in Moray, nationally this is 44%.

There is no one thing that can be addressed that will fix this issue and adequately prepare today's children to enter tomorrow's workplace. However, the foundation work is already being put in place which this Early Years STEM initiative can further build on. In line with Moray's STEM strategy for Education, activities to raise the profile, knowledge and understanding of STEM subjects have been undertaken in recent years in both primary and secondary schools.

While work in Early Learning and Childcare is further developing, a good start has been made with the implementation of Talking Tubs to stimulate discussion about different vocations including those STEM related. This links to early work with practitioners around gender imbalance training which ties in with the play pedagogy approach.

However, there needs to be further work undertaken to create a culture change to promote STEM working where children and their families see the opportunities in engaging with the STEM curriculum thereby removing the barriers to attainment.

For positive attitudes to be embedded in terms of STEM, this culture change needs to begin at a pre-school age and then sustained through the young person's progression through primary and secondary school levels. The incorporation and focus on early years STEM is a unique feature of this business case.

While this document draws upon a number of case studies of STEM activities at primary and secondary school levels, there are few case studies at the critically important Early Learning and Childcare phase. To further develop and embed the approach across Early Learning and Childcare (ELC), Moray Council (ELC) will work in partnership with RAF Lossiemouth to provide a STEM Hub as part of their expanded ELC support. This will consist of one room within their childcare facilities. The insights gained from this pilot will be used to inform the development and delivery of the Full Business Case and in particular how STEM will be embedded within each Moray Associated School Group (ASG).

Underpinning this business case is the issue of equalities (see challenge 4). In Moray there is a serious issue of female underemployment despite men being no better qualified. This highlights the stereotypical gendered subject choices made at an early age made by young people.

Stereotypes about what is a 'man's job' and what is a 'woman's job' are affecting the chosen career paths and these stereotypes are often established at a very young aged. These barriers need to be removed and the culture changed from a pre-school age (as noted above). If this is not the case then we risk losing potential output to underemployment and out-migration.

Although in recent year years there has been some evidence of improvement, the horizontal and vertical gendered segregation of the local employment market was highlighted in a 2017 report by Ekosgen, prepared for Highlands and Island's Enterprise. This revealed that in Moray 68% of Managers, Directors and senior officials are male. The research also shows that men and women work in different roles to a greater extent than is found in the Highlands and Islands and Scotland. Women are more prevalent in education, health, hotel and restaurant work with men more prevalent in manufacturing, construction and professional services. The report states that subject choices through gender stereotyping have a role to play in this issue. The full report can be viewed here.

The final threat to the skills make-up of the region is its rural nature. Children in all parts of Moray need to have access to the same or similar infrastructure and learning within a reasonable distance no matter their location. If children in the more rural areas do not have access to the same variety of experience as those in more urban areas then their view of the available opportunities will narrow and attitudes towards skills and employment will remain unchanged. The Early Years STEM initiative also provides a good opportunity to build on the exemplary work already undertaken by Moray rural schools in terms of promoting learning opportunities -including STEM- through digital connectivity.

To this end, the project must also be able to change attitudes towards STEM within the homes of young learners. The 2013 ASPIRES report by Kings College London found that the chances of a young person going on to study STEM are greatly influenced by the amount of STEM capital in the family. STEM capital is the qualifications, knowledge, understanding and interest in STEM a child is exposed to at home. The report overwhelmingly found that children with a high amount of STEM capital in the home are much more likely to aspire to a STEM career. The full report can be read here.

How will we fix the issues?

In line with the Early Intervention approach taken across wider services in Moray, STEM learning activities will be initiated at the ELC stage. This acknowledges that to increase attainment in STEM we will need engage with children in the early years (ages 3 – 8) setting to generate interest in the STEM curriculum once the children are older.

To do this requires a multi-pronged approach beginning before children start school and sustained through primary and secondary school education levels. Capital investment will be made into facilities that are fit for purpose not only for teaching STEM but for inspiring learners to engage with the curriculum. It is recognised that there is not a one size fits all and each Associated School Group (ASG) areas needs will be assessed individually to decide what would unlock the greatest benefit in that ASG.

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It is acknowledged that to engage and inspire young people in STEM requires a whole system approach where parents, employers, siblings and teachers are all engaged with and supportive of the benefits a comprehensive education in STEM disciples will bring.

This will require a culture change amongst all these groups and the investment in physical infrastructure that happens will reflect that the facilities should be scalable to allow all of these groups to engage with STEM.

To further embed this culture change the project will look create a STEM delivery post, which in turn will lead to the creation of STEM ambassadors. While the STEM ambassador role is currently Grampian wide, developing locally focused STEM ambassadors will give a stronger focus to developing outreach programmes to engage with parents in Moray. STEM training provide by the Scottish Government free of charge will form part of teachers CPD training to facilitate the roll out of new STEM activity, along with other training as necessary. Once again, our experience in promoting STEM to date in Moray gives a strong foundation to build on.

Working with partners such as developing the young workforce, Moray College UHI and the private sector, employers will be engaged to host STEM activities and facilities at industry sites to allow young people to see for themselves STEM activity being brought to life, generate excitement and interest in STEM and embed knowledge of the opportunities that are possible in Moray. In these locations inter-generational learning can be further enhanced by this initiative.

It is crucial that this STEM initiative is not viewed in isolation. It builds on the work already undertaken to date in Moray and should be considered in the context of the Council's STEM and Raising Attainment Strategies. Furthermore, its wider role in the growth deal should be recognised. Projects such as the MAATIC facility, Manufacturing and Innovation Moray and Digital Health initiative are all looking to deliver STEM subjects or create STEM jobs. This project is the one that enables young people in Moray to benefit from those projects by helping them obtain the qualifications required to do so.

As previously noted, the Project Board is delighted that we will be in a position to test our approach learning through the delivery of an ELC STEM Hub at RAF Lossiemouth. The learning from this pilot will inform our Full Business Case and the further development of our approach in relation to each of the Moray ASG's.

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Who is involved?

The Project board is made up of the following organisations:

- Moray Council
- Highlands and Islands Enterprise
- Moray College UHI
- The University of the Highlands and Islands (UHI)
- Skills Development Scotland (SDS)
- Developing the Young Workforce (DYW Moray)
- NHS Grampian
- Boeing
- Gordon and MacPhail
- RAF Lossiemouth

How did we identify the solution?

An initial set of options was developed at the strategic outline business case stage. When the project board was formed to move to outline business case completion two workshops were held to revisit the investment objectives and options as per the guidance in the *HM Treasury Guide to Developing the Project Business Case, Supplementary Guidance to the HM Treasury Green Book*.

During the first workshop it was decided that the options were not sufficiently distinct from each other and should be amended to enable a more comprehensive cost benefit analysis to be undertaken. The project manager then further developed the options and engaged board members one on one before holding a second workshop where the options were presented, further refined and approved.

What is the solution?

The solution is to offer specialist bespoke facilities and environments in the 8 Associated School Groups. This will facilitate STEM learning while engaging with the wider stakeholder group to change attitudes towards STEM and eventually the culture around how STEM is perceived in the region. These facilitates will have core learning equipment that will be updated periodically and will allow inter-generational learning to take place. Through a Moray wide approach, a distinctive feature of this project is the intent to address rurality as a barrier to participation in relation to STEM activities.

Each ASG will be assessed for need to identify where investment is required to unlock the greatest benefits and deliver the greatest impact. This recognises that the geography and STEM provision in each ASG is different and a one size fits all approach will not work.

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As part of the development of the Full Business Case, the project team will engage with stakeholders in relation to determining the most appropriate and cost effective way of delivery the STEM project in their area.

This could mean for example renovating existing space, partnering with other growth deal projects, using vacant units in towns and villages or new builds.

A mobile solution will be developed to allow the latest innovations to be showcased around the region. STEM content evolves and develops quickly and this solution allows these innovations to be showcased around the region as they happen for one eighth the cost. This will be further enhanced through digital connectivity.

With our public and private sector partners industry facilities and events will be developed to allow STEM learning to happen on site, providing an inspiring environment for children and adults to learn in while allowing them to see STEM in practice. These innovative facilities could then attract further investment that would allow the offering to be expanded to other learners. The project will look to work with other Moray Growth Deal Projects to unlock mutual benefits.

An example of good practice that the Moray STEM project has learned from is Raising Aspiration in Science pilot project (RAiSE) was launched in Moray. In 2016, the 23 month project was jointly funded by the Wood Foundation, Scottish Government and Moray Council. The total cost of the project was around £160,000 with the primary expense being employing a Primary Science Development Officer. The main focus of the programme was to increase competence and confidence in practitioners in the delivery of STEM curriculum.

Alongside this specific one off events and learning methods were trialled to engage pupils and parents in STEM. Further info of this activity in Moray can be found here.

An external evaluation of the RAiSE programme at the national level (other Local Authorities also took part) was conducted by Glasgow University and found that of those children involved with RAiSE 87% had enjoyed more challenge and 77% had increased their STEM aspirations. The evaluation can be found here

This is a high impact for a relatively small project over a short timeframe and highlights that impacts can be made and attitudes changed. The Early Years STEM initiative intends to learn and build on this success thereby further embedding cultural change in Moray.

The Scottish Parliament Education and Skills Committee report on STEM in early years education (2019) heard from practitioners and experts in the field that these one off or add on events have a part to play in delivering STEM however by themselves will not embed STEM in learning as needs to be the case. Other topics in that report include the highlighting the importance of young people experiencing other environments and inter disciplinary learning, the Benefit of Science centres as part of the mix and how forming clusters can benefit knowledge exchange. The report can be found here

By having a mobile solution that provides additional, inspiring and one of events it will bring the benefits of a science centre to Moray. Providing the fixed facilities will embed the learning and give practitioners the opportunity to develop and enhance their skills over time and allow the benefit of knowledge transfer that clusters in each ASG will bring. The industry based sites will provide the inspiring environments that have been demonstrated to raise STEM aspiration in young people.

A key point of this initiative is that the examples and case studies of activities given in Appendix 5, which have been successful. These point to the further benefits of being able to scale up such initiatives over the long term allowing measurable, demonstrable benefits to be gained in an inclusive and equitable way benefitting all.

The RAiSE programme and the success of the facilitator in delivering the project demonstrate that the new permanent post is crucial to maximising the impact of the capital spend. However, the RAISE programme also demonstrates the importance of being able to sustain this role over an extended period of time.

Examples of activity that could take place at scale as part of the project for early years and primary children are given in Appendix 5. The focus on earlier years is a new field of investment and the STEM office if approved would be responsible for developing activities for roll out.

The rationale for focusing on early years STEM is that the evidence tells us that attitudes towards STEM are formed at a younger age than when most STEM activity begins in education. The ASPIRES report states that if a child is not interested in STEM by the age of 10 then their aspirations will not have increased in STEM by the age of 14.

Research from the University of Sheffield states that gender stereotype reinforcement has been found in children as young as 6. This shows that for young girls intervention must be made early. The full University of Sheffield report by Marsh et al can be read here.

How much will it cost?

The capital budget for the project is £4.8 million. Part of this investment (£3.4 million) will be split amongst the 8 Associated School groups, not necessarily equally, but depending on need and existing space. The spend on this element will therefore be between capital build, renovation, training and equipment with a budget to update equipment during the life of the project. Where it is an option using partner space will be explored.

There will be an allocation to procure a mobile solution (£1 million) and to partner with public and private sector organisations (£400,000) to develop joint facilities at industry locations.

The project will look to gain leverage and additionallity to the investment wherever possible by exploring partnerships with other Moray Growth Deal Projects to utilise space and sharing costs.

Moray Council will be asked to approve a STEM officer post (£60,000 per annum) to continue and accelerate the process of changing the culture around STEM and setting up a network of STEM ambassadors in each ASG. This post would also be responsible for the mobile solution and liaising with public and private sector partners to set up the industry focused network of sites. This represents a significant revenue ask to Moray Council and other revenue streams will be explored through Moray Council's external funding team. This posts would however be critical to unlocking the benefits of the project.

How will it be delivered?

The project will be delivered by Moray Council using a phased approach dictated by need and spend profile of the Moray Growth Deal.

The mobile solution and culture change aspects of the projects should be the first to be procured. The mobile STEM unit would provide an early opportunity to showcase a Moray Growth Deal project in 2021/22.

The sites in each of the 8 ASGs will be procured when budget allows and will be based on the need in that area and existing provision and geographical location.

The partnership industry sites will be developed alongside the sites being developed in each ASG as partnerships are formed and funding is available.

How will the benefits accrue?

To summarise how the benefits for this project will accrue it is easier to start at the end point, which is a workforce trained and qualified in STEM disciplines. This workforce will then be able to benefit from the opportunities of technological change and earn salaries that reflect the skilled nature of their jobs. This in turn increases the level of disposable income in the region and the well trained workforce makes Moray a place where businesses look to locate and invest.

This workforce is also able to benefit from the opportunities that will arise in the skilled workforce to work remotely allowing the benefits of well paid jobs located elsewhere in the world to be spent locally.

These benefits will however only be realised 10-15 years from the date the project begins. Before entering the workforce they will have had to go through further or higher education. A Moray College UHI curriculum that is aligned with the current and future needs of businesses in Moray will enable not only those coming through the Moray school system to study here but also attract students from out with the region.

Throughout senior phase qualifications will have been obtained in STEM subjects with students equalling or surpassing their peers nationally. This will have been enabled by the investment in interventions through broad general education that this project will make.

Throughout the life of the project improvement in core curriculum for excellence competencies will be monitored against the pre intervention baseline to ensure the intervention is responsive and dynamic to best practice and emerging trends.

While these benefits are for the end goal of providing well paid meaningful employment the benefit to the individual of improved education throughout early years to adulthood cannot be underestimate. By improving attainment at all levels young people will be more self-confident, have higher self-esteem and improved opportunities throughout their life.

Is it financially sustainable?

The capital elements of the project will be supported from a mix of funding from Scottish Government and Moray Council funding. With the capital elements a sustainability plan for the assets will need to be developed in conjunction with the Councils assets management project. By utilising existing space in some school settings, vacant units and new buildings joined to existing premises ongoing revenue costs should be minimised.

It is proposed to request revenue spending for a post to co-ordinate STEM activity within Schools settings, liaise with education on fit within broad general education, operate the mobile solution, create partnerships and develop opportunities with public and private sector partners and facilitate training of professional involved in the teaching of STEM, which will lead to series of STEM ambassadors.

The mobile solution will also require an ongoing revenue stream however it is projected that this element could attract private sector sponsorship and running costs will be low

How does the project fit in the strategic landscape?

At the local level the project aligns with the ambition of the Moray Economic Strategy outcomes of increased qualification levels, business growth and skills alignment. Specific KPIs in the strategy relate to increases in STEM qualifications and apprenticeships.

The Local Outcome Improvement Plan (LOIP) for Moray aims to increase skills and pay levels in the area to lead to higher skilled employment, with KPIs measuring qualification levels.

The Moray Council Corporate Plan looks to *create a step change in the regional economy to enable inclusive economic growth* which this project will contribute to through allowing young people to take up opportunities and participate fully in the labour market. This outcome is measured by an increase in higher skilled jobs and wage levels.

At the national level this project aligns Scottish Government STEM strategy, Scotland’s Economic Strategy and the UK Governments Industrial Strategy.

The below table shows how this project will deliver the 4 themes of the Scottish Government STEM Strategy

STEM Strategy Theme	How It Will Be delivered
To build the capacity of the education and training system to deliver excellent STEM learning so that employers have access to the workforce they need;	The project will invest in bespoke learning areas in the school environment, inside and outside, and at inspiring locations at industry sites in Moray. Linking the learning in schools at an early age with exposure to industry will help link labour supply and demand.
To close equity gaps in participation and attainment in STEM so that everyone has the opportunity to fulfil their potential and contribute to Scotland's economic prosperity	The rural nature of Moray means that there are inequalities in the opportunities available. This project will focus on ensuring that no matter where in Moray you live you have access to the same opportunity. The mobile solution will further enhance this.
To inspire children, young people and adults to study STEM and to continue their studies to obtain more specialist skills	By exposing children at a young age to business locations this will inspire them to undertake a STEM career by helping with their understanding of what STEM actually is. The project will also look to engage with parents to change attitudes and build STEM Capital in the home.
To connect the STEM education and training offer with labour market need – both now and in the future – to support improved productivity and inclusive economic growth	This project focuses on early years and primary therefore the benefits will not be realised for some time. The project does however have a wide range of bodies such as SDS and HIE that have an understanding of future labour demand and will guide the delivery of the projects towards that.

What else is happening in the region?

One of the largest developments currently taking place in Moray is the development of the growth deal itself. This project is integral to the success of other projects within the deal. The Moray Advanced Aviation, Technology and innovation Centre is to offer higher and further education qualifications STEM subjects unique to the Highlands and Islands. The Manufacturing Innovation Moray centre is looking to work with businesses to help introduce new technology which will require STEM skills. The Digital Health innovation is looking to pilot innovative technology to revolutionise rural health care, again requiring STEM skills to implement and grow.

Without this STEM project helping young people in Moray to obtain skills in STEM those projects won't be able to attract the talent they need from the region and young people in Moray will not be able to benefits from the opportunities of the growth deal.

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STEM is the bedrock of opportunities that will arise from the Moray Growth Deal Investment.

Alongside this and benefitting the Moray Growth Deal and the region is the £400 million investment in RAF Lossiemouth that is bringing jobs and investment to the region and enabling some of the growth deal projects.

What else needs to be done?

At the Full Business Case stage, the sites will be identified with local stakeholders and appraisals undertaken to identify the needs in each Associated School Group. The project board will be expanded to include more private sector representation. A new member from renewable energy company Statkraft has been identified and will join the board in the New Year. Discussions have also taken place with the Education Scotland STEM Officer (North Region), who will be joining the board for full business case and will be able to bring the latest best practice to the project.

Approval needs to be sought from Moray Council for the revenue funding for the post. If approved, these posts will work on the development of the curriculum and start to change the culture around STEM with ELC, Primary and Secondary School practitioners.