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for today and tomorrow?

ARTICLES

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Isaac Atta Senior Ampofo and Isaac Atta Junior Ampofo

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Global education: The need for innovative approach towards engaging intellectually brilliant students

Isaac Atta Senior Ampofo and Isaac Atta Junior Ampofo*

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Abstract: Education is recognized as a universal vehicle for the transmission of values' and ideas' for the development of the complete individual in connection to society's changing reality. High-quality education can help individuals develop their minds and help society transform economically, socially, and politically. The quality of education provided to such individuals brings out intellectually brilliant students who need to be engaged in a way that will help them utilize their intellectual abilities. What then are the needs of intellectually brilliant students in today's education? To probe further, the study explores the innovative approach to achieve the intellectually brilliant students' needs. A qualitative approach was adopted for the study. Ten intellectually brilliant students were studied as case studies. Semi-structured 45-minute focus groups/ interviews were conducted with the selected students, resulting in a total of 10 interviewees. Intellectually brilliant students need worldwide technological collaboration to grow their intellectual abilities to meet the needs of the world in terms of human resources, food security, job creation, infrastructure development, and social stability. Field teachers need tolerance, effort, and time to assess their own sentiments toward intellectually brilliant students and come up with teaching goals with them. Intellectually brilliant students need worldwide technological collaboration to grow

* **Isaac Atta Senior Ampofo** (correspondent author, ampofoisaac10@yahoo.com) is a PhD Information Technology student at the Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

Isaac Atta Junior Ampofo (ampofoisaac159@yahoo.com), a graduate in MSc. Management and Human Resource Strategy, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

More information about the authors is available at the end of the article.

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their intellectual abilities to meet the needs of the world in terms of human resources, food security, job creation, infrastructure development, and social stability.

Keywords: Education; innovative approach; student needs; brilliant students; intellectual; teacher.

I. Introduction

Education is recognized as a universal vehicle for values and ideas transmission¹ for the development of the complete individual in connection to society's changing reality.² Various groups have proposed ideas over the years to refocus educational goals on the socioeconomic demands of society.³ For education to be a successful instrument in tackling societal problems, it may be necessary to indigenize resources in educational programs.^{4,5} The quality of knowledge provided through educational institutions is essential to a country's competitiveness.⁶ Only high-quality education can help individuals develop their minds while also assisting society in economic, social, and political transformation.^{7,8} The quality of education provided to such individuals brings

¹ Jenny Hatley, "Universal Values as a Barrier to the Effectiveness of Global Citizenship Education: A Multimodal Critical Discourse Analysis," *International Journal of Development Education and Global Learning* 11, no. 1 (2019): 87-102, <https://doi.org/10.18546/IJDEGL.11.1.06>.

² Muassomah Muassomah, Irwan Abdullah, Istiadah Istiadah, Anwar Mujahidin, Nurnaningsih Masnawi, and Sohrah Sohrah, "Believe in literature: character education for Indonesia's youth," *Universal Journal of Educational Research* 8, no. 6 (2020): 2223-2231, <https://doi.org/10.13189/ujer.2020.080605>.

³ Francesco Avvisati, Gwenaël Jacotin, and Stéphan Vincent-Lancrin, "Educating higher education students for innovative economies: What international data tell us," *Tuning Journal for Higher Education* 1, no. 1 (2013): 223-240.

⁴ Alan Reid, "Climate change education and research: possibilities and potentials versus problems and perils?," *Environmental Education Research* 25, no. 6 (2019): 767-790, <https://doi.org/10.1080/13504622.2019.1664075>.

⁵ Caroline Vandekinderen, Griet Roets, Hilde Van Keer, and Rudi Roose, "Tackling social inequality and exclusion in education: From human capital to capabilities," *International Journal of Inclusive Education* 22, no. 1 (2018): 1-20, <https://doi.org/10.1080/13603116.2017.1362044>.

⁶ Sepehr Ghazinoory, Shohreh Nasri, Fatemeh Ameri, Gholam Ali Montazer, and Ali Shayan, "Why do we need 'Problem-oriented Innovation System (PIS)' for solving macro-level societal problems?," *Technological Forecasting and Social Change* 150 (2020): 119749, <https://doi.org/10.1016/j.techfore.2019.119749>.

⁷ Paula Crespí, "How higher education can develop generic competences?," *IJAEDU-International E-Journal of Advances in Education* 6, no. 16 (2020): 23-29, <https://doi.org/10.18768/ijaedu.616003>.

⁸ Hosam Al-Samarraie, and Shuhaila Hurmuzan, "A review of brainstorming techniques in higher education," *Thinking Skills and Creativity* 27 (2018): 78-91, <https://doi.org/10.1016/j.tsc.2017.12.002>.

out intellectually brilliant students who need to be engaged in a way that will help them utilize their intellectual abilities.^{9,10} To this article, intellectually brilliant students are defined as students who are naturally innovative, knowledgeable, and brilliant in a specific area. These intellectually brilliant students can do intellectual things through visions and dreams they get about themselves and are able to practice them. Intellectually brilliant students are not common in society, and it is very difficult to identify such individuals.^{11,12} Therefore, how are these intellectually brilliant students identified? To probe further, what are the behavioral characteristics of an intellectually brilliant student? It is not necessary for a brilliant student to be inherently brilliant. A clever student is simply one who studies excellently, working with rather than against his or her brain's natural processes.^{13,14} The increase in an individual's ability to think and reason is referred to as cognitive or intellectual development.¹⁵ Not frequently, but we see such students showing their abilities through innovations and creativity.¹⁶

⁹ Helena Eriksson, Sara Högdin, and Anna Isaksson, "Education and Career Choices: How the School Can Support Young People to Develop Knowledge and Decision-Making Skills," *Universal Journal of Educational Research* 6, no. 9 (2018): 1900-1908, <https://doi.org/10.13189/ujer.2018.060907>.

¹⁰ Nadarajan Thambu, Harun Joko Prayitno, and Gamal Abdul Nasir Zakaria, "Incorporating active learning into moral education to develop multiple intelligences: A qualitative approach," *Indonesian Journal on Learning and Advanced Education (IJOLAE)* 3, no. 1 (2021): 17-29, <https://doi.org/10.23917/ijolae.v3i1.10064>.

¹¹ Emily M. Kuntz, and Erik W. Carter, "Review of interventions supporting secondary students with intellectual disability in general education classes," *Research and Practice for Persons with Severe Disabilities* 44, no. 2 (2019): 103-121, <https://doi.org/10.1177/1540796919847483>.

¹² Meg Grigal, and Clare Papay, "The promise of postsecondary education for students with intellectual disability," *New Directions for Adult and Continuing Education* 2018, no. 160 (2018): 77-88, <https://doi.org/10.1002/ace.20301>.

¹³ Pablo Medina, Natalia Ariza, Pablo Navas, Fernando Rojas, Gina Parody, Juan Alejandro Valdivia, Roberto Zarama, and Juan Felipe Penagos, "An unintended effect of financing the university education of the most brilliant and poorest Colombian students: The case of the intervention of the Ser Pilo Paga program," *Complexity* 2018 (2018): 1-9, <https://doi.org/10.1155/2018/3528206>.

¹⁴ Lysann Zander, and Elisabeth Höhne, "Perceived peer exclusion as predictor of students' help-seeking strategies in higher education," *Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie* 53, no. 1-2 (2021): 1-15, <https://doi.org/10.1026/0049-8637/a000235>.

¹⁵ Alan S. Kaufman, *Contemporary intellectual assessment: Theories, tests, and issues*. Guilford Publications, (2018), https://books.google.co.uk/books?hl=en&lr=&id=JA1mDwAAQBAJ&oi=fnd&pg=PP1&dq=Contemporary+intellectual+assessment:+Theories,+tests,+and+issues&ots=VBDHC3hLcv&sig=9LZGc02pfAUaOYkd5nMBNs5JxU&redir_esc=y#v=onepage&q=Contemporary%20intellectual%20assessment%3A%20Theories%2C%20tests%2C%20and%20issues&f=false.

¹⁶ Gavkhar Nazarkulovna Pirmanova, Musallam Akhmadovna Safarova, Zilola Farmonovna Khalilova, Nargiza Samartdinovna Tashpulatova, and Nodira Suyundikovna

Students with intellectual abilities show their talent by producing aeroplanes, cars, trains, light from renewable sources of energy, products to serve as a supplement to building materials, advancing theories etc. These intellectual students can develop and identifying their capabilities through formal and informal education.^{17, 18} Some of such individuals find themselves in a good environment that will help them develop and grow their abilities through the help of investors, entrepreneurs, philanthropists, and formal education at an early stage.¹⁹ On the other hand, many of these intellectual students do not get the support from formal education that will help them develop and grow their talents. They are normally found in countries where their education systems are not too dynamic. In some developed and developing countries, their education systems do not provide an avenue for intellectually brilliant students, so they end up dropping their abilities to follow the mass.²⁰ Thus, there is a need for such countries to develop an innovative approach to engage intellectually brilliant students. Therefore, what innovative approach is needed for intellectually brilliant students? The innovative approach can be implemented in various educational institutions through the teachers. These teachers will need effective development professionals to keep their knowledge and skills up to date in a continually changing educational environment to meet intellectually brilliant students' needs.²¹ Continuous school improvement and traditional educational practices based largely on undertaking more of similar nonetheless better are widely

Normatova, "Development of intellectual and creative activity of teenagers in the study of historical and cultural monuments of England," *Linguistics and Culture Review* 5, no. S2 (2021): 1346-1354, <https://doi.org/10.21744/lingcure.v5nS2.1820>.

¹⁷ Elizabeth A. McCullough, Eva Y. Ma, Salwa Al-Noori, and Rebecca M. Price, "STEP forward: combining formal and informal education to develop communication skills that augment postdoctoral training," *Journal of STEM Outreach* 3, no. 1 (2020): 1-10, <https://doi.org/10.15695/jstem/v3i1.12>

¹⁸ A. I. Satdykov, and B. A. Sazonov, "Recognition of qualifications obtained as a result of non-formal and informal learning: foreign experience and prospects for Russian practice," *Vysshee obrazovanie v Rossii= Higher Education in Russia* 29, no. 11 (2020): 98-111, <https://doi.org/10.31992/0869-3617-2020-29-11-98-111>.

¹⁹ Archanya Ratana-Ubol, and Weerachat Soopunyo, "Community network development for integrating non-formal education and informal education in schools," *Kasetsart Journal of Social Sciences* 42, no. 3 (2021): 558-563, <https://so04.tci-thaijo.org/index.php/kjss/article/view/253480>.

²⁰ Sjur Bergan, "The European Higher Education Area: A road to the future or at way's end?," *Tuning Journal for Higher Education* 6, no. 2 (2019): 23-49, [https://doi.org/10.18543/tjhe-6\(2\)-2019pp23-49](https://doi.org/10.18543/tjhe-6(2)-2019pp23-49).

²¹ Risto Leinonen, Markku Haaranen, Mikko Kesonen, Mika Koponen, Pekka E. Hirvonen, and Mervi A. Asikainen, "Finnish Graduated Physics Teachers' Views about Their

acknowledged as ineffective.²² Furthermore, the following study question is addressed by the study:

1. What are the needs of intellectually brilliant students?

II. Methodology

High school students from top three best Senior High Schools in Ghana made up the study population. The top three best Senior High Schools in Ghana are Premph College, Opoku Ware School, and Presbyterian Boys' Secondary School (PRESEC). Ten intellectually brilliant students were studied as case studies in this study. The selection criteria for students deemed intellectually brilliant were established based on traits like remarkable cognitive capacities, academic success, the ability to solve problems, and evidence of creativity or originality. Considering the identification of the intellectually brilliant students, their behavioral characteristics, and student needs were among the major themes. 'Every day, I learn something new'. 'Spaced repetition reinforces facts; studying using active recall, creating knowledge networks, seeking to make associations', and 'academic performance' were the major concerns in relation to the identification of intellectually brilliant students. Integrated STEM education, quality education, teacher knowledge, and innovative approaches were all sub-themes concerning students' needs. Examining the chosen students' present the nature of innovations and professional learning, along with the pertinent documentation materials (academic success, and evidence of creativity or originality) of these students, were among the data sources for the larger study. As a result, a mixed-methods approach was adopted. The goal of combining a variety of research methodologies and tools was to provide the researchers confidence in the conclusions while also assuring breadth, rigor, richness, and complexity of the data.²³ According to Miles and Huberman,²⁴ interviews were used as part

Teacher Education Program: The Disparity between the Needs and Delivery," *Journal of technology and science education* 10, no. 1 (2020): 101-116, <https://doi.org/10.3926/jots.e.820>.

²² Rehaf A. Madani, "Analysis of Educational Quality, a Goal of Education for All Policy," *Higher Education Studies* 9, no. 1 (2019): 100-109, <https://doi.org/10.5539/hes.v9n1p100>.

²³ Uwe Flick, *The SAGE Handbook of Qualitative Research Design*, SAGE, (2022), <https://www.torrossa.com/it/resources/an/5282289>.

²⁴ Matthew B. Miles, and A. Michael Huberman, *Qualitative data analysis: An expanded sourcebook*. Sage, (1994): 27, https://books.google.co.uk/books?hl=en&lr=&id=U4IU_-wJ5QEC&oi=fnd&pg=PR12&dq=Qualitative+data+analysis:+An+expanded+sourcebook&ots=kGTE3ETQWV&sig=8bPoEtMoQgdBCQ0JRv9yegt9g_I&redir_esc=y#v=onepage&q=Qualitative%20data%20analysis%3A%20An%20expanded%20sourcebook&f=false.

of the research process, as is customary in qualitative research, to “delve deeper into the motives of participants and their motives for replying as they do”. Case studies were applied to investigate behavioral characteristics in precise settings of intellectually brilliant students,²⁵ with the goal of improving intellectual development and growth rather than making broad generalizations.²⁶ Propositions can then be established and utilized to relate components or concepts and propose generalizability, as Punch²⁷ explains, “bringing up notions or propositions for testing in later research.” Purposive sampling was used in the selection procedure, meaning that participants were specifically picked based on their capacity to offer rich and informative data pertinent to the study issues. In this instance, the researchers looked for students who were willing to participate in the study and who satisfied the requirements for intellectual genius.

Using ten case-study students’ purposive sample identified as intellectually brilliant over the past 20 years, this paper reflects on some of the data in connection to their precise needs and factors to consider in identifying intellectually brilliant students, as well as some examples cited by the students about their behavioral characteristics. Thus, the researchers looked through already-existing records, such as student performance reports, teacher recommendations, and/or evidence of creativity or originality. The researchers examined a wide variety of students from various cohorts or academic years. The researchers were able to identify patterns or trends in the requirements and traits of students with exceptional intellectual ability over time thanks to this longitudinal technique. Semi-structured 45-minute focus groups/interviews were conducted with the selected students, resulting in a total of 10 interviewees. This implies that the students themselves were involved in the selection process by self-nomination and teacher or peer nomination. The researchers were able to investigate several facets of the students’ experiences and viewpoints because of the use of mixed methodologies. The student needs from teachers, students’ needs for intellectual development, their identity and behavioral characteristics were among the topics discussed. Students were asked to identify their expectations of teachers, as well as any modifications made to classroom methods. The use of self-reflective reports by the selected students was a major strategy.

²⁵ Louis Cohen, Lawrence Manion, and Keith Morrison, *Research methods in education*, Routledge, (2002), <https://doi.org/10.4324/9780203224342>.

²⁶ Robert E. Stake, “Qualitative case studies,” *In N. K. Denzin & Y. S. Lincoln (Eds.), The Sage handbook of qualitative research* (3rd ed., pp. 443–466), (2005), Sage Publications Ltd.

²⁷ Keith F. Punch, *Introduction to social research: Quantitative and qualitative approaches*, Sage, (2013): 154, <https://www.torrossa.com/en/resources/an/5019425>

Whereas there are concerns about self-reporting with regards to socially desired deception and responses,²⁸ several researchers have stated that self-reported viewpoints are acknowledged as valid and valuable, particularly once combined with the analysis of other sources of data and student work samples.²⁹ This was followed by transcription, digital recording, and manual notetaking of interviews, which were applied in this research. Students were then requested to make any necessary changes to the written transcripts as well as provide any extra information or evidence of their needs. Multiple transcripts' read-throughs, putting notes in the margins about main concepts, and classifying and interpreting using coding open-ended were used to conduct the analysis, with main sub-themes and themes developing as a result.³⁰ With regards to ethics, permission for this study was received from Prempeh College, Opoku Ware School, and Presbyterian Boys' Secondary School (PRESEC) as well as the educational system concerned. Each interviewee/focus group participant gave their informed consent, and further verification was done by providing written transcripts to interviewees for alterations. Real names are substituted with [...] in this report to protect confidentiality, especially regarding any direct quotations from interviewees. The research has limitations, such as only ten case studies and ten focus groups or interviews; it is likewise acknowledged that this is limited research with many self-reporting. Results should be regarded with caution regarding generalizability and transferability because of these constraints.

III. Findings

There were several instances outlined concerning how intellectually brilliant students can be identified because of their work and learning within innovation, with numerous student interviewees. One student, for example, who has learnt to be flexible with assessment and presenting styles, described

²⁸ Thea F. Van de Mortel, "Faking it: social desirability response bias in self-report research," *Australian Journal of Advanced Nursing, The* 25, no. 4 (2008): 40-48, <https://search.informit.org/doi/abs/10.3316/INFORMIT.210155003844269>.

²⁹ Vicki Vescio, Dorene Ross, and Alyson Adams, "A review of research on the impact of professional learning communities on teaching practice and student learning," *Teaching and teacher education* 24, no. 1 (2008): 80-91, <https://doi.org/10.1016/j.tate.2007.01.004>.

³⁰ John W. Creswell, Vicki L. Plano Clark, Michelle L. Gutmann, and William E. Hanson, "Advanced mixed methods research designs," *Handbook of mixed methods in social and behavioral research*, 209, no.240, (2003):209-240, https://books.google.co.uk/books?hl=en&lr=&id=F8BFOM8DCKoC&oi=fnd&pg=PA209&dq=Advanced+mixed+methods+research+designs.+&ots=gXbQyxuuQg&sig=MK e92aCzYK2Nb7wze1HfmRTroI0&redir_esc=y#v=onepage&q=Advanced%20mixed%20methods%20research%20designs.&f=false

an observation of a colleague who is an intellectually brilliant student, using academic excellence, and commented that:

[...] not all intellectually brilliant students excel academically. Some are bad because their abilities do not match the education system. Such students need an education system that will focus on their abilities for them to be able to develop their intellectuals (Student Interview 9).

The following are the remaining responses of the students:

[...] Every day, intellectually brilliant students learn something new. This method outperforms cramming in terms of long-term knowledge retention and recall. These tactics are certainly not similar. One of them is far superior to the other in terms of promoting long-term retention of the material (Student Interview 1).

[...] Spaced repetition is a study approach that allows intellectually brilliant students to pick and choose what they want to study and review on any given day. We meticulously schedule each follow-up review for a single fact using spaced repetition. The period between reviews gets longer with each successful review. The period between reviews gets shorter with each error. The timeline for each single fact is adjusted dependent on how well the student can recall that fact in spaced repetition review. Each well-timed review gives the student an opportunity to improve his or her memory (Student Interviews 7 and 5).

Spacing repetition has been shown to be effective. It allows students to retain more information with significantly less effort. Spacing repetition aids exceptional students in remembering and recalling what they have learnt.

Another student commented that “intellectually brilliant students actively recollect the material they are learning to make their memory as strong as possible” (Student Interview 10). Without studying, it is possible to hear a fact once and recall it correctly for days, weeks, or even months afterwards. It is feasible to transform students’ minds into knowledge nets that catch knowledge in the same way that a fishnet catches fish. Knowledge nets are comprised of knowledge since they exist in our brains. The type of knowledge used to create the net will likely determine the type of knowledge it will catch. One student said that “for intellectually brilliant students, we can make a new net, and they will catch a whole new field of knowledge” (Student Interview 4). Another student commented that “intellectually brilliant students actively strive to build new linkages with it.” They achieve this by actively exploring, reading, and researching for information that can be linked to something they’ve learned (Student Interview 3). Another student stated that “intellectually brilliant students learn by connecting new

information to information already available on the internet” (Student Interview 2). Knowledge networks become stronger as they are used more frequently. This behavior is referred to as “creating associations” by cognitive scientists. Making associations is the process of connecting one item of info in a student’s lasting memory with another piece of information in his long-term memory. Both memories are strengthened because of this process. Also, making associations is the process of transforming long-term memory into sophisticated cognitive reasoning skills, allowing children to progress from memory to creative and original thinking. Another student commented that “intellectually brilliant students explore their abilities by following their instinct and thoughts” (Student Interview 6). Lastly, “intellectually brilliant” students get dreams and visions of their abilities being put into practice. That is where they will seek to accomplish that with or without the help of formal education or philanthropists (Student Interview 8).

IV. Behavioral characteristics of an intellectually brilliant student

Intellectual learners tend to take a lot of initiative in their learning at the start of their field placement assignment.³¹ Because they have read widely, examined their circumstances, and formed a frame of reference within which they relate to social workers and clients, the students feel safe. The theoretical content of academic courses stimulates students, and they succeed in this area.³² Their early case recordings reveal a curiosity in people, a willingness to guess about the meaning of behavior, and the ability to recognize both tangible and emotional difficulties. The following are the responses of the students:

[...] Intellectually brilliant students display remarkable skills in the diagnostic area as their field experience increases. They are well-organized, logical, succinct, and conceptual. However, when they are required to do more than just deliver physical services, issues may develop. These students grow irritated with the requirement to think through the exchanges needed in the relationship process because theoretical learning is so easy for them. Their expectations of themselves are high, and they are quickly disheartened by their lack of “doing” accomplishment (Student Interview 3).

³¹ Fareeda Ibad, "Personality and ability traits of teachers: student perceptions," *Journal of Education and Educational Development* 5, no. 2 (2018), ERIC.

³² Rebecca L. Hagedorn, and Melissa D. Olfert, "Food insecurity and behavioral characteristics for academic success in young adults attending an Appalachian university," *Nutrients* 10, no. 3 (2018): 361, <https://doi.org/10.3390/nu10030361>.

Another student commented that “intellectually brilliant students are able to spot barriers in their initial encounter with people living in a career of their intellectual abilities.” However, transitioning these students from a problem-solving mindset to a client-centered mindset is tough (Student Interview 6).

[...] Intellectually brilliant students over-prepare for interviews and become frustrated when they must be flexible. As a result, when flexibility is necessary, perspectives are frustrated. As a result, they may overlook the significance of working in the career field. The students’ desire to make a speedy change may overwhelm the investor, entrepreneur, or philanthropist, resulting in termination or a lack of response (Student Interview 1).

[...] Intellectually brilliant students struggle with field learning and put a lot of pressure on field teachers. Many of their issues arise from a strong desire to succeed and a fear of being pushed to act before they have enough knowledge based on the course content. As a result, their safety is jeopardized when they are compelled to focus on the emotional content of the assisting relationship (Student Interview 9).

Another student responded that: “in response to their uneasiness, the students look for a magic formula that will provide them with clear and unambiguous directions on how to perform better beyond understanding” (Student Interview 5). Another student commented that “intellectually brilliant students feel scared by criticism and are less willing to take risks.” They try to keep control of conference periods to protect themselves. They may concentrate on facts about which they are familiar or try to reason abstractly (Student Interview 2). Lastly, one student commented that:

[...] For these students, self-awareness is significantly more distressing. They fight hard and long to maintain past learning and performance patterns, often afraid that they may lose intellectual prestige and regress rather than advance (Student Interview 10).

V. Student needs

Every interviewed student in this study stated that their collegial learning in community that is professional resulted in educational variations and development of attitudes and skills pertinent to the 21st century emphasis on lifetime learning,³³ comprising proof of the engagement-improved results

³³ Dylan Wiliam, "The role of formative assessment in effective learning environments," *The nature of learning: Using research to inspire practice* (2010), 135-155.

links.³⁴ The students mentioned a variety of learning experiences needed to improve student engagement, such as learning how to use technology in game-focused learning, co-planning that led to further inventive skills of learning for students, and co-teaching that included more educator fun, communication, and numerous clarifications that eventually assisted students educating. Relating to their intellectual development and what they want to achieve, the students suggested that intellectually brilliant students should be engaged entirely in an educational system that focuses on their abilities and nothing else. But you will see individuals finding themselves in an educational system that has no relationship with their abilities. Specifically, most such students can do more when they get to university. So, what happens to the unfortunate ones that, for financial reasons, are not able to continue at university? The university serves as a steppingstone for intellectually brilliant students where they mostly explore their abilities because of how the system is structured based on specialization. Should it always be at the university? Why not at all levels of the educational ladder? Many intellectually brilliant students need to be engaged in their respective specializations from infancy so that they get more time to invent and contribute to the solutions of the world, as many have done over decades. Some of these intellectually brilliant students have been able to change the world with their dedicated time and effort towards their intellectual abilities. The interviewed students showed us their self-reported needs as follows:

[...] I want to be a physicist and would like to significantly contribute to theories and the development of new concepts in physics. I have been inspired by people like Marie Curie, whose pioneering research into radioactivity led her to develop radiography mobile units to offer services of X-ray to ground clinics in World War I. Another person is Albert Einstein, who is most well-known for developing relativity's general theory. He was a student and physics' professor at the University of Zurich when Nobel Prize in Physics in 1921 was awarded to him. Though Einstein is recognized best for starting relativity theory, he likewise significantly contributed to quantum mechanics' development. Quantum mechanics and relativity are modern physics' two cornerstones. To achieve my goals and those of students who are within my intellectual abilities, laboratories, well-structured educational systems, learning materials, and conducive environments should be provided for us to be able to achieve our goals (Student Interview 10).

³⁴ Brenda J. McMahon, and David Zyngier, "Student engagement: Contested concepts in two continents," *Research in comparative and international education* 4, no. 2 (2009): 164-181, <https://doi.org/10.2304/rcie.2009.4.2.164>.

[...] I am working hard to be able to contribute to biology. As such, renowned people like Charles Darwin is known for his work in evolutionary biology. Charles Darwin's theory that every living thing descends from common lineages is widely now regarded and recognized as a scientific fundamental principle. Early fascination of Darwin with nature driven him to sacrifice his studies in medical at Edinburgh University for supporting in marine invertebrates' study. His five-year trip on the Beagle HMS cemented his reputation as a leading geologist, whose theories and findings backed up the geological slow change theory of Charles Lyell. Intellectually brilliant students should be given the support and opportunity to explore their field of study. These students need to be exposed to many Nobel laureates who have achieved a lot and have contributed to society. There should be a need for the world to connect such people across the world through innovative programs to bring the best out of them (Student Interview 5).

[...] Being an activist and civil rights advocate has been my passion. I see that there is more to explore in the aspect of civil rights to contribute to what the minister, legendary activist, and leader of civil rights Martin Luther King applied civil disobedience and nonviolence to get civil rights for individuals of color in US, impacted by Mahatma Gandhi's peaceful activism and his Christian convictions. Through his intellectual abilities, the Civil Rights Act of 1964, the Voting Rights Act of 1965, and the Fair Housing Act of 1968 became important legislative victories. So, intellectually brilliant students of that nature would want to get platforms to deliver what they have explored (Student Interview 2).

One student commented that: "I have loved computers since childhood and would want to be a computer scientist like Tim Berners-Lee, who is widely regarded as the World Wide Web inventor." However, intellectual students in the field of computer science will need major investment to enable them to explore and contribute to the field of computer science (Student Interview 8).

V.1. Integrating STEM education

There are various conflicting theories, techniques, and ideas in STEM education's greater field.³⁵ According to Kelley and Knowles,³⁶ integrated

³⁵ Michael J. Prince, and Richard M. Felder, "Inductive teaching and learning methods: Definitions, comparisons, and research bases," *Journal of engineering education* 95, no. 2 (2006): 123-138, <https://doi.org/10.1002/j.2168-9830.2006.tb00884.x>.

³⁶ Todd R. Kelley, and J. Geoff Knowles, "A conceptual framework for integrated STEM education," *International Journal of STEM education* 3, no. 11 (2016): 1-11, <https://doi.org/10.1186/s40594-016-0046-z>

STEM education, for example, stresses more or two STEM topics' intentional integration using an authentic and relevant setting, for example, technology and engineering design issues. Sanders³⁷ notes "Integrative STEM education comprises techniques that examine teaching and learning between and among any two or more of the STEM subject areas, and/or between a STEM topic and one or more other school subjects". Wells and Ernst³⁸ argue that "integrative STEM education is equally applicable at the natural intersections of learning within the continuum of content areas, educational environments, and academic levels." Wells and Ernst³⁹ further argue, emphasizing the use of engineering and technology design situations to teach content from multiple areas. Beyond STEM education, all the students in the ten case studies were active in co-teaching with at least one other coworker, some in interdisciplinary efforts, with some employed in teams with multi-age, and others in specific-discipline team teaching circumstances. In a secondary senior team setting, one student charted that:

[...] This integrative approach should be based on the premise that students should learn across topics rather than just inside them, and that this learning occurs as students integrate knowledge and content from many areas into the larger framework of an open-ended problem (Student Interview 3).

Sanders⁴⁰ writes that "the underlying point is that the ideas and practice of science and technology are so tightly interwoven that we don't see how any of them can be performed properly in isolation from the others." Harris and deBruin⁴¹ claim that eliminating traditional discipline divisions' siloed approach boosts output and stimulates creativity during a student's academic career. Through problem-based learning activities, these strategies can offer a foundation for subject-area knowledge application and stimulate cross-cutting ability practice.

³⁷ Mark E. Sanders, *Stem, stem education, stemmania*. (2008), 21, <https://vtechworks.lib.vt.edu/server/api/core/bitstreams/b5f37b87-c914-4e5a-8abc-f9b491dc2e36/content>.

³⁸ John G. Wells, *Integrative STEM education at Virginia Tech: Graduate preparation for tomorrow's leaders*, (2013), 1, <https://vtechworks.lib.vt.edu/server/api/core/bitstreams/5168d010-69fa-46af-8767-0d410e0a793b/content>.

³⁹ John G. Wells, *Integrative STEM education at Virginia Tech: Graduate preparation for tomorrow's leaders*, (2013), 1, <https://vtechworks.lib.vt.edu/server/api/core/bitstreams/5168d010-69fa-46af-8767-0d410e0a793b/content>.

⁴⁰ Mark E. Sanders, *Stem, stem education, stemmania*. (2008), 23, <https://vtechworks.lib.vt.edu/server/api/core/bitstreams/b5f37b87-c914-4e5a-8abc-f9b491dc2e36/content>.

⁴¹ Anne Harris, and Leon R. De Bruin, "Secondary school creativity, teacher practice and STEAM education: An international study," *Journal of Educational Change* 19 (2018): 153-179, <https://doi.org/10.1007/s10833-017-9311-2>

V.2. Educational robotics

To promote the notion of educational robots, we believe it is necessary to define existing methodologies and the commonly accepted paradigm in this field. Without claiming to be exhaustive, we based our findings on an examination of the materials we have access to^{42, 43, 44} and others. It may be said that the goals of educational robots, which are currently the focus of educators, are to: foster the development of new types of engaged, devoted, and self-sufficient people; to detect early on the technical preferences of students and nurture them in this direction, thereby defining the engineer's career from kindergarten through the time of employment; to have a significant influence on the development of students' cognitive processes and speech (sensory development, attention, thinking development, spatial imagination, memory), as well as creative abilities and emotional sphere; to combine theory and practice in the study of subjects such as physics, mathematics, informatics, and others); to ensure the interaction of education, science, and production. Individual students demonstrated increased self-confidence and emotional learning. One student, for instance, presented evidence in the form of a video of him developing a car and driving it on the road. In one part of the video, he showed how he was learning how to program to add additional features to the car. He then commented that "students that you'd regard as not high achieving may be those that need educational robotics the most" (Student Interview 6). Another student from a dissimilar educational setting shared an instance of how he gained confidence in programming robots to perform specific functions because of an innovative program that occurred in his community, with the student benefiting from the teacher's learning from working within his intellectual abilities, which included implementing pedagogical improvements. The outcomes of these students are:

[...] argued that educational robotics is now a well-constituted phenomenon, beginning to play an increasingly important role in the development of the

⁴² Lai Poh Emily Toh, Albert Causo, Pei-Wen Tzuo, I-Ming Chen, and Song Huat Yeo, "A review on the use of robots in education and young children," *Journal of Educational Technology & Society* 19, no. 2 (2016): 148-163, <https://www.jstor.org/stable/jeductechsoci.19.2.148>.

⁴³ Elena Ospennikova, Michael Ershov, and Ivan Iljin, "Educational robotics as an innovative educational technology," *Procedia-Social and Behavioral Sciences* 214, (2015): 18-26, <https://doi.org/10.1016/j.sbspro.2015.11.588>.

⁴⁴ Fabiane Barreto Vavassori Benitti, "Exploring the educational potential of robotics in schools: A systematic review," *Computers & Education* 58, no. 3 (2012): 978-988, <https://doi.org/10.1016/j.compedu.2011.10.006>.

engineering thinking of the younger generation. They have shown themselves to be permanent and developing, in the sense that a certain level of hardware, software, and equipment achieved will naturally produce the next improved level. As a result, educational robotics should be implemented in our educational system to help students identify their abilities and improve upon them (Student Interview 7).

V.3. Quality education

Quality education refers to education that is relevant to society's requirements.⁴⁵ He maintained that in a complex and globalized society, such needs should be met through growth, health, and physical existence norms. It indicates that education is useful when it equips people with the essential skills, knowledge, concepts, values, and attitudes to make informed decisions and lead self-sufficient lives. Quality education, according to Majasan,⁴⁶ should promote disciplined behavior, hard work, a better cultural legacy, and mutual respect both outside and within the community school. Education quality is the answer if a society anticipates manpower quality for rapid transformation and development. Overall, one student commented that "quality education is hoped to solve essential concerns such as labor dignity, effective leadership, and engaged citizenship, as well as political stability, industrial harmony, security, self-reliance, and religious tolerance" (Student interview 9). Similarly, students in other settings said that they are participating reliably in curriculum co-creating material, student participation, and replicating student success beyond the overarching topics' initial co-planning. They commented that "educational institutions' products must be capable of living to expectations and competing favorably with their counterparts in other parts of the world" (Student interview 4). Schooling that makes a whole person is regarded to be of high quality. Complete in that the individual has reached their complete moral, intellectual, physical, social, and emotional possibility. Consequently, no quality education can be damaging more than absence of education, highlighting that without quality there is no value in education.⁴⁷

⁴⁵ C. B. Ndiomu, "Standard and the National Policy on Education associated hydra headed problem," *Quality in education. Benin-City: Supreme ideal publisher* (1989), Benin City: Supreme Ideal International Ltd.

⁴⁶ Michael Crossley, and Graham Vulliamy, *Qualitative educational research in developing countries: current perspectives*, Routledge (2013), <https://doi.org/10.4324/9781315889191>.

⁴⁷ Olga Belash, Mikhail Popov, Nicolai Ryzhov, Yan Ryaskov, Sergey Shaposhnikov, and Mikhail Shestopalov, "Research on university education quality assurance: Methodology and results of stakeholders' satisfaction monitoring," *Procedia-Social and Behavioral Sciences* 214, (2015): 344-358, <https://doi.org/10.1016/j.sbspro.2015.11.658>.

V.4. Teacher knowledge

The term “teacher knowledge” is frequently used to refer to the information and skills that teachers require in their jobs. Shulman’s⁴⁸ broad framework is widely accepted in the scholarly community as describing the most important aspects of educator knowledge to some extent. Teacher knowledge is allocated into 3 domains in this framework: content, pedagogical content, and curricular knowledge. Shulman⁴⁹ later added to this model by giving it a fine structure with 7 domains labeled pedagogical general knowledge, content knowledge, content pedagogical, learners, curriculum knowledge and their features, contexts of education knowledge, and educational knowledge values, purposes, and ends. The models stated above do not advocate for any subject specific, nonetheless rather define teacher expertise generally. Though, investigations into subject-precise educator and content pedagogical knowledge for several disciplines have been conducted.^{50, 51} Classically, this research is built around the framework of Shulman or is quite like it. This research links the framework of Shulman to subject-precise topic knowledge, making it more useful to teacher educators and teachers than the framework of Shulman⁵² alone. There are three different categories of subject matter expertise. The term “common content knowledge” (CCK) defines the information that individuals who know and use mathematics have. In turn, specialized content knowledge (SSK) defines the knowledge that is required for effective mathematics education. Content knowledge Horizon (CKH) defines how mathematics and computer science topics in the curriculum are associated with one another. Three knowledge domains make up knowledge pedagogical content. Students and content knowledge (SCK) refers to understanding how students acquire specific subjects, while teaching and content knowledge (TCK) refers to understanding

⁴⁸ Lee S. Shulman, "Those who understand: Knowledge growth in teaching," *Educational researcher* 15, no. 2 (1986): 4-14, <https://doi.org/10.3102/0013189X015002004>.

⁴⁹ Lee S. Shulman, "Those who understand: Knowledge growth in teaching," *Journal of Education* 193, no. 3 (2013): 1-11, <https://doi.org/10.1177/002205741319300302>.

⁵⁰ Melanie M. Keller, Knut Neumann, and Hans E. Fischer, "The impact of physics teachers' pedagogical content knowledge and motivation on students' achievement and interest," *Journal of Research in Science Teaching* 54, no. 5 (2017): 586-614, <https://doi.org/10.1002/tea.21378>.

⁵¹ Mika Koponen, Mervi A. Asikainen, Antti Viholainen, and Pekka E. Hirvonen, "How education affects mathematics teachers' knowledge: Unpacking selected aspects of teacher knowledge" *Eurasia Journal of Mathematics, Science and Technology Education* 13, no. 6 (2017): 1943-1980, <https://doi.org/10.12973/eurasia.2017.01209a>.

⁵² Lee Shulman, "Knowledge and teaching: Foundations of the new reform," *Harvard educational review* 57, no. 1 (1987): 1-23, <https://doi.org/10.17763/haer.57.1.j463w79r56455411>.

successful teaching practices for assured themes and events. Knowledge of curriculum and content (KCC) comprises information about curricula, for example when and how a particular arithmetic topic is normally imparted.⁵³ As a result, one interviewed student commented that:

[...] Teachers of today should be provided with development professionals to achieve the students' needs assigned to them. To assist students in learning, teachers must be professional and up to date on pedagogical content knowledge. In the twenty-first century, teachers should go beyond what they know to learn more about what students want, the best teaching practices, and the content that needs to be taught (Student interview 1).

VI. An approach to meet the needs of intellectually brilliant students

Intellectually brilliant students are more difficult to spot than the other two types of students. Intellectually brilliant students often use their abilities to perform and produce on an intellectual level to protect themselves.⁵⁴ Learning may progress intellectually, but it will fall apart when put into practice. Although intellectual grasp is a first step toward professional education's goals, the student does not change until he or she can do things differently.⁵⁵ One student commented on the innovative approach to meeting their needs that:

[...] When students effortlessly and effectively finish the first phase of their study, field teachers should be provided and trained to aid students in completing the second step by assisting them in attaining some success in practice beyond providing tangible services or adhering to agency protocols (Student interview 5).

However, before students can integrate one with the other, intellectually brilliant students require time to explore how theory applies to a specific scenario. It's important not to rush them into their feeling zones before they're ready. As this process proceeds, field teachers must continue to encourage students to talk about their feelings. Students are frequently aware

⁵³ Deborah Loewenberg Ball, Mark Hoover Thames, and Geoffrey Phelps, "Content knowledge for teaching: What makes it special?," *Journal of teacher education* 59, no. 5 (2008): 389-407, <https://doi.org/10.1177/0022487108324554>.

⁵⁴ Fareeda Ibad., "Personality and ability traits of teachers: student perceptions.," *Journal of Education and Educational Development* 5, no. 2 (2018), ERIC.

⁵⁵ Laura M. Desimone, "Improving impact studies of teachers' professional development: Toward better conceptualizations and measures," *Educational researcher* 38, no. 3 (2009): 181-199, <https://doi.org/10.3102/0013189X08331140>.

of relevant comments from people that have an interest in their abilities but seek assistance with their own responses. Additional efforts should be made to assist intellectually brilliant students in perceiving different aspects of a scenario to pique their interest and creativity. Another student commented that:

[...] Intellectually brilliant students might redirect their inclination to categorize others by using a range of case materials. Increased emphasis on case assignments and, as a result, more contact with society are the most effective ways to meet learning demands in general (Student interview 7).

This allows students to identify people who have an interest in their abilities and recognize their desire to impose their own beliefs on them. It also allows them to analyze causative elements for behavior early in the field experience. As a result, students are reoriented to focusing on the problems of people who have an interest in their abilities because of the variety and greater number of encounters. Students might detect their own lack of emotional connection and begin to think about why their responses are ineffective by discussing the function of the social worker. As a result, they seek out other techniques and reactions. Another student commented that:

[...] Intellectually brilliant students are less introspective, and as a result, their ability to understand their interactions with people who have an interest in their abilities is absorbed at a slower rate. Repeated discussions may help them become more conscious of their relationships with people who have an interest in their abilities and disciplined in their use of self in the interview (and the value of their own feelings) (Student Interview 9).

The students' willingness to recognize their shortcomings is directly proportional to their level of familiarity with the field teacher. Students look up to the field teacher as a role model for a social worker, and they often feel compelled to test the relationship before committing to it. Because of the provoking nature of intellectually brilliant students' emotions toward supervision and the risk of perpetuating their shortcomings, teachers must be aware of their own feelings. Field teachers must be cognitively interesting to assist students in recognizing and working effectively within their learning patterns while emphasizing the advantages of experiential and intuitive learning modalities. It takes time for these students to put their feelings to the test, trust them, and feel at ease with them. This type of student, who may be viewed as a "know-it-all," may cause teachers to react defensively. Field teachers need tolerance, effort, and time to assess their own sentiments toward these students and come up with teaching goals with them.

VII. Conclusion

In this era of global economic order, education has become the sole viable option for providing useful and relevant education to everybody. As a result, any attempt by a country not to match its education with global demands in the twenty-first century and beyond is equal to socioeconomic backwardness. Intellectually brilliant students need worldwide technological collaboration to grow their intellectual abilities to meet the needs of the world in terms of human resources, food security, job creation, infrastructure development, and social stability. Intellectually brilliant students are distinguished in large part by their advanced thinking and reasoning skills, which result in the creation of novel concepts and inventive ideas. They are defined as people who can use both academic and informal education to develop and recognize their own strengths. But as the research points out, not all smart students, especially those in less dynamic educational environments, get the assistance they need from formal education institutions. Intellectually brilliant students are unique in that they have the capacity to make a substantial positive impact on society by coming up with novel solutions to challenging issues. In conventional learning environments that might not sufficiently meet their needs, this potential is frequently unrealized. Thus, creative methods are needed to effectively engage students who are intellectually brilliant.

The study emphasizes how crucial it is to identify intellectually brilliant students by considering a variety of criteria outside of typical academic performance. Key markers included traits like active memory, spaced repetition, flexibility in assessment, and the capacity to link disparate elements of knowledge. This comprehensive knowledge goes beyond academic performance to give depth to the body of research on identifying students who are intellectually brilliant. The study explores the behavioral traits of students who are intellectually brilliant, illuminating their propensity for initiative, diagnostic aptitude, and problem-solving capabilities. It highlights the need to comprehend their difficulties, such as switching from a problem-solving to a client-centered perspective and the requirement for assistance in field learning settings. The study offers insightful information about the educational goals of intellectually brilliant students and the assistance they need to attain them, as it features the voices of these students themselves. The study highlights the necessity for educational systems to address the unique demands of intellectually brilliant students, from specialized learning environments to exposure to role models and chances for inquiry. The study promotes creative strategies, such as integrated STEM education, educational robotics, and quality education efforts, to engage

students who are intellectually brilliant. These methods emphasize the value of encouraging intellectually brilliant students' creativity, critical thinking, and interdisciplinary learning while also being in line with current trends in education research. The study emphasizes the role that professional development plays in providing teachers with the skills and pedagogical content knowledge needed to effectively educate intellectually brilliant students. It also highlights the significance of teacher knowledge in meeting the requirements of these students.

Prempeh College, Opoku Ware School, and Presbyterian Boys' Secondary School (PRESEC) are three of Ghana's finest senior high schools where intellectually brilliant students were examined as part of the study's methodology. Ten intellectually brilliant students were chosen as case studies based on a variety of factors, including exceptional cognitive abilities, academic achievement, the capacity to solve problems, and indications of originality or creativity. Using a mixed-methods approach, the study combined quantitative data sources like academic performance records and indications of creativity with qualitative interviews. Ten students were interviewed in all, during 45 minutes of semi-structured interviews with the chosen students. Purposive sampling was used in the selection procedure, meaning that participants were picked based on their potential to give rich and insightful data pertinent to the goals of the study. Examining pre-existing documents, such as teacher recommendations, student performance reports, and indications of innovation or originality, was another aspect of data collecting. Using a longitudinal method, the researchers examined patterns and trends in the characteristics and needs of intellectually brilliant students over the previous 20 years. The interview data was collected by transcription, digital recording, and hand notetaking. It was then coded and reviewed through several times to find themes and sub-themes. The key topics covered were how to recognize intellectually brilliant students, what traits they exhibit in terms of behavior, and what the needs of the students are. Integrated STEM education, high-quality instruction, teacher expertise, and creative problem-solving were highlighted. By getting approval from the selected educational institutions and guaranteeing informed consent from each participant, ethical concerns were taken care of. Pseudonyms were used in lieu of real interviewee names in the report to ensure confidentiality.

Despite the small sample size, a particular subset of students who were judged to be intellectually brilliant were targeted by the selection criteria. By taking a multifaceted approach, the results are more likely to be true and reliable and to be applicable outside of the study's particular setting. While Ghanaian high school students were the study's primary focus, intellectually

gifted children in different cultural and educational contexts may find resonance in the themes and findings related to identification, behavioral traits, student needs, and instructional techniques. The study's emphasis on comprehending the background and experiences of the students deepens the applicability of its conclusions. Transferability examines the relevance and applicability of findings to similar environments, whereas generalizability refers to the degree to which findings can be applied to different populations. The study's thorough descriptions of the needs, actions, and experiences of the students enable readers to evaluate how applicable the findings are to populations of intellectually gifted students in their own situations.

VIII. Recommendation

Countries that can identify intellectually brilliant students and engage them in a way that will promote their intellectual abilities to solve societal problems will benefit in the future. These intellectually brilliant students that are helped will be an asset to these countries and will help other students be able to do what they do and do it better. Thus, these intellectually brilliant students will strengthen the education systems of these countries in the future.

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About the authors

ISAAC ATTA SENIOR AMPOFO (ampofoisaac10@yahoo.com) is a Ghanaian by birth. Ampofo is the corresponding author who reviews literature, analyses, and concludes research papers. Ampofo Isaac Atta Senior is a researcher at the International Association of Advanced Studies Research. Ampofo has research experience in Education, Information Technology, Applied Mathematics, Cybersecurity, Digital Forensics, and Machine Learning Algorithm. He holds an MSc in Information Technology Education and is a PhD Information Technology student at Kwame Nkrumah University of Science and Technology from Jan. 2022 - Sept. 2025. I am studying a 1-year MSc Advanced Computer Science at the University of Liverpool from Sept. 2023 - Sept. 2024 to enhance my knowledge. I have a strong foundation in Research, Information Technology and Mathematics and have had working experience as a Teaching Assistant at the University of Education Winneba, Ghana during my National Service from Sept. 2018 - Sept. 2019. Ampofo, Isaac Atta Senior would love to be contacted for research grants and contracts.

ISAAC ATTA JUNIOR AMPOFO (ampofoisaac159@yahoo.com) assisted in the analysis of the work, proofreading and grammar check. Ampofo, Isaac Atta Junior is currently a researcher at IAAS Research. Ampofo has research experience in Education, Management, Human Resource and Computing. He holds Bachelor of Business Administration in Management and MSc. Management and Human Resource Strategy. He was a Teaching Assistant for University of Education Winneba which helped him improve on his research skill. Being interested in research has provided him with practical research experience. Ampofo, Isaac Atta Junior can be contacted through ampofoisaac159@yahoo.com. Ampofo, Isaac Atta Junior would love to be contacted for research grants and contracts.