PENGEMBANGAN *MOBILE LEARNING* Gen 21cs PADA PERKULIAHAN GENETIKA UNTUK MENINGKATKAN KETERAMPILAN ABAD 21 CALON GURU BIOLOGI

DISERTASI

Diajukan untuk Memenuhi Sebagian dari Syarat untuk Memperoleh
Gelar Doktor Kependidikan dalam Bidang
Pendidikan Ilmu Pengetahuaan Alam

PROMOVENDA
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PROGRAM STUDI PENDIDIKAN IPA
SEKOLAH PASCASARJANA
UNIVERSITAS PENDIDIKAN INDONESIA
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2021

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PENGEMBANGAN *MOBILE LEARNING* Gen 21cs PADA PERKULIAHAN GENETIKA UNTUK MENINGKATKANKETERAMPILAN ABAD 21 CALON GURU BIOLOGI

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PERNYATAAN

Dengan ini saya menyatakan bahwa Disertasi dengan judul "**Pengembangan *Mobile Learning* Gen 21cs pada Perkuliahan Genetika untuk Meningkatkan Keterampilan abad 21 Mahasiswa Calon Guru**" beserta seluruh isinya adalah benar-benar karya saya sendiri, Saya tidak melakukan penjiplakan atau pengutipan dengan cara-cara yang tidak sesuai dengan etika ilmu yang berlaku dalam masyrakat keilmuan. Atas pernyataan ini, saya siap menanggung resiko/sanksi yang dijatuhkan kepada saya apabila dikemudian hari ditemukan adanya pelanggaran etika keilmuan dalam karya saya ini, atau ada klaim dari pihak lain terhadap keaslian karya saya ini.

Cirebon, Januari 2021

Yang Membuat Pernyataan

Yuyun Maryuningsih

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Penelitian disertasi ini dilatarbelakangi oleh adanya kebutuhan untuk meningkatkan keterampilan abad 21 mahasiswa calon guru melalui aplikasi pembelajaran *mobile* Gen 21cs yang telah dikembangkan penulis pada perkuliahan genetika. Kegiatan perkuliahan saat ini belum secara optimal menfasilitasi keterampilan abad 21 melalui kegiatan diskusi online. Keterampilan abad 21 merupakan keterampilan yang harus dimiliki oleh semua generasi muda sebagai bekal menghadapi tantangan global di masa depan. Harapan penulis, hasil dari penelitian ini memberikan kontribusi bagi perkembangan ilmu pengetahuan di bidang pendidikan sains. Hasil dari penelitian ini juga melahirkan beberapa rekomendasi proses pembelajaran *mobile* yang dapat diterapkan dan dikembangkan lebih lanjut pada jenjang perguruan tinggi atau jenjang menengah.

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ABSTRAK

PENGEMBANGAN *MOBILE LEARNING* Gen 21cs PADA PERKULIAHAN GENETIKA UNTUK MENINGKATKAN KETERAMPILAN ABAD 21 CALON GURU BIOLOGI

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Partisipasi mahasiswa yang rendah karena keterbatasan waktu dalam kegiatan diskusi pembelajaran disiasati dengan diskusi *online*. Genetika merupakan bidang ilmu biologi yang perkembangannya pesat, perlu diintegrasikan dalam proses pembelajaran dengan diskusi berpendekatan pemecahan masalah. Kegiatan diskusi *online* melalui media sosial dengan menggunakan *smartphone* disinyalir dapat meningkatkan kemampuan 4C, yaitu komunikasi, kolaborasi, berpikir kritis dan berpikir kreatif inovatif. Kelemahan penggunaan media sosial pada kelas yang banyak, menimbulkan penurunan kinerja *smartphone*. Pengembangan *mobile learning* yang diberi nama Gen 21cs pada perkuliahan genetika merupakan solusi terbaik dalam menjawab permasalahan tersebut. Penelitian ini bertujuan untuk mengembangkan program *mobile learning* Gen 21cs pada perkuliahan genetika untuk meningkatkan kemampuan 4C. Pengembangan pembelajaran *mobile* mengunakan *Design Development Research*. Implementasi program dilakukan pada mahasiswa semester V pada perguruan tinggi di Cirebon, Indonesia. Uji coba program secara terbatas dihasilkan bahwa program dapat diimplementasikan dalam kegiatan perkuliahan genetika. Implementasi program dilakukan secara eksperimental pada tiga kelompok dengan perlakuan pendekatan diskusi *online* yang berbeda yaitu permasalahan dari mahasiswa, dari mahasiswa dan pendidik, dan dari pendidik. Hasil uji coba luas didapatkan program *mobile learning* Gen 21cs pada perkuliahan genetika meningkatkan kemampuan 4C pada mahasiswa. Program *mobile learning* Gen 21cs berkontribusi positif kuat antar domain kemampuan 4C pada mahasiswa, berkontribusi dalam meningkatkan penguasan konsep genetika pada mahasiswa dan berkontribusi positif cukup kuat antara kemampuan 4C dengan penguasan konsep genetika pada mahasiswa.

Kata kunci: pembelajaaran *mobile*, diskusi *online*, pendekatan pemecahan masalah, kemampuan 4C, gentika, penguasaan konsep.

ABSTRACT

DEVELOPING THE Gen 21cs OF MOBILE LEARNING IN GENETICS CLASS TO IMPROVE THE 21st CENTURY SKILLS OF BIOLOGY TEACHER CANDIDATES

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An online discussion can solve students' low participation caused by limited time for a learning discussion. Genetics is a field of biology that receives rapid development and is necessarily integrated with a learning process through discussion with a solving-problem approach. Online discussion activities utilizing smartphone is believed to improve students' 4C skills: communication, collaboration, critical thinking, and innovative-critical thinking. However, using social media in many classes will decrease smartphone performance. Developing mobile learning, known as Gen 21cs in genetics class, is the best solution to solve such a problem. This study aims to develop a Gen 21cs mobile learning program in genetics class to improve students' 4C skills. This mobile learning program was developed by employing Design Development Research. This program was implemented in students of semester 5 at a university in Cirebon, Indonesia. The limited tryout revealed that the program was applicable to a genetics class. The program was implemented experimentally in three online discussion groups that received different approaches: problem-from-students, problem-from-student-and-educator, and problem-from-educator. The extensive tryout reveals that implementing the Gen 21cs mobile learning program in a lecture can improve the students' 4C skills. The Gen 21cs mobile learning program positively contributes to the students' domains of 4C's, significantly improves their genetics concept mastery, and strongly contributes their 4C skills to their genetics concept mastery.

Keywords: mobile learning, online discussion, problem-solving approach, 4C skills, genetics, concept mastery

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DAFTAR LAMPIRAN

DAFTAR PUSTAKA

Abdillah, Toto N, Subanji, Hery S & Abadyo, (2016). The Students Decision Making in Solving Discount Problem. *International Education Studies Canadian Center of Science and Education* 9(7).

Abrami, P. C., Bernard, R. M., Bures, E. M., & Borokhovski, E. (2011). Interaction in distance education and online learning: using evidence and theory to improve practice. *Journal of Computing in Higher Education*, *23*(2–3). 82–103.

Acedo, Clementina & Hughes C., (2014). Principles for Learning and Competences in The 21st-Century Curriculum. *Prospects* 44.*503–525*

Akyol Z., & Randy G. D., (2011). Understanding Cognitive Presence in an Online and blended Community of Inquiry. Assessing Outcomes and Processes for Deep Approaches to Learning. *British Journal of Educational Technology.* 42(2). 233–250

Alasmari T., & Zhang, K. (2019). Mobile learning technology acceptance in Saudi Arabian higher education: an extended framework and a mixed-method study. *Education and Information Technologies*, 24(3). 2127–2144.

Allchin, D. (2000). Mending Mendelism. *The American Biology Teacher, 62*(9). 633–639.

Alozie, N., Eklund, J., Aaron, R., & Krajcik, J. (2010). Genetics in the 21st century: the benefits & challenges of incorporating a project-based genetics unit in biology classrooms. *The American Biology Teacher, 72*(4). 225–230.

Anderson, & Terry, (2008). The Theory and Practiceof Online Learning. *Au Press, Athabasca University*

Andrew S, Evelyn D., & Cjocelyn W., (2015). Advancing Ethics Frameworks and Scenario-Based Learning To Support Educational Research Into Mobile Learning, *International Journal of Research and Method In Education* 38(3). *320–334,*

Anohah, E., Oyelere, S. S., & Suhonen, J. (2017). Trends of mobile learning in computing education from 2006 to 2014. *International Journal of Mobile and Blended Learning, 9*(1). 16–33.

Armstrong M., (1978). Assessing Students' Participation in Class Discussion, *Assessment In higher Education,* 3(3*). 186-202,*

Armstrong M. & David B., (1983). Assessing Participation in Discussion. *An exploration of The Issues, Studies in Higher Education,* 8(1). *33-44,*

Asay, Sylvia M., Cfle, & Beverly C. M., (2003). Implementing and assessing A Critical Thinking Problem Solving Project, *Journal of Teaching In Marriage and Family,* 3(3). *375-398.*

Aubusson P, Sandy S & Kevin B (2009). Mobile Learning for Teacher Professional Learning. Benefits, Obstacles And Issues ALT-J, *Research In Learning Technology* 17(3). *233–247*

Awadaghada, (2016). Effect of Whatsapp on Critique writing Proficiency and Perceptions Toward Learning. *Cogent Education,* 3. *1264173*

Azevedo, Behar B. F. T, Berni P. A. E. (2011). Qualitative Analysis of Discussion Forums, *International Journal of Computer Information Systems and Industrial Management Applications.* ISSN 2150-7988 (3) Pp. 671-678

Bagdasarov Z., Luo Yupeng & Wu Wei, (2017). The Influence of Tablet based Technology on The Development of Communication and Critical Thinking Skills. An interdisciplinary Study, *Journal of Research on Technology in Education,* 49(1-2). 55-72.

Bai, H. (2019). Pedagogical practices of mobile learning in K-12 and higher education settings. *Tech Trends, 63*(5). 611–620

Baird J.A., David A., Therese N H. & Gordon S., (2017). Assessment and Learning. Fields Apart? *Assessment in Education. Principles, Policy & Practice,* 24(3). *317-35.*

Balaji S, M. Anddiganta, & Chakrabarti, (2010). Student Interactions in Online Discussion Forum. Empirical Research From 'Media Richness Theory' Perspective, *Journal of Interactive Online Learning* 9(1)

Bannan A., John C., & Norbert P., (2015). Reconceptualizing Design Research in The Age of Mobile Learning, *Interactive Learning Environments,*

Barhoumi & Chokri. (2015). The Effectiveness of Whatsapp Mobile Learning Activities Guided by Activity Theory on Students' Knowledge Management, *Contemporary Educational Technology*, 6(3). *221-238*

Batardière, & Thérèse M., (2015). Promoting Critical Thinking in Online Intercultural Communication. *The Eurocall Review,* 23(1).

Beckmann, Jennifer, Weber & Peter, (2015). Cognitive Presence in Virtual Collaborative Learning. Assessing and Improving Critical Thinking in Online Discussion Forums. *International Conference E-Learning*

Bello, J., Butler, C., Radavich, R., York, A., Oseto, C., Orvis, K., & Pittendrigh, B. R., (2007). Genomics analogy model for educators (GAME): VELCRO ® Analogy model to enable the learning of DNA arrays for visually impaired and blind students. The Science Education Review, 6(4). 123:1-123:12.

Bethany V, & Bowling, (2008). Development and Evaluation of A Genetics Literacy Assessment instrument For Undergraduates. *Genetics Society of America*

Beuchot A. & Mark B. (2005). Interaction and Interpersonality in Online Discussion Forums, *Distance Education,* 26(1). 67-87.

Bhardwajraj K.K, (2015). Research Trends in Mobile Learning. A Global Perspective, *COLLNET Journal Of Scientometrics and Information*

Management ISSN . 0973-7766 (Print) 2168-930X (Online). 9(2). *Pp. 205-224,*

Biasutti, & Michele (2017) A Coding Scheme to Analyse The Online Asynchronous Discussion Forums of University Students, *Technology, Pedagogy and Education,* 26(5). *601-615,*

Bidarra, José & Rusman, Ellen (2016). Towards a Pedagogical Model for science Education. Bridging Educational Contexts through a Blended Learning Approach, Open learning. *The Journal of Open, Distance and E-Learning,*

Bildt C. & Smith G., (2016). The one and future internet *Journal of Cyber Policy* 1(2) 142-156

Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble, M. (2012). Defining twenty-first century skills. In P. Griffin & E. Care (Eds.), *Assessment and teaching of 21st century skills: Methods and approach* (pp. 17–66). Dordrecht, the Netherlands: Springer.

Black P. & Wiliam D, (2018). Classroom Assessment and Pedagogy, *Assessment in Education. Principles, Policy and Practice,*

Boerwinkel & Jan D., (2011). Raising Awareness of Pre-Symptomatic Genetic Testing, *Journal of Biological Education,* 45(4).

Boerwinkel, D. J., Yarden, A., & Waarlo, A. J. (2017). Reaching a consensus on the definition of genetic literacy that is required from a twenty-first-century citizen. *Science & Education*, 26(10). 1087–1114.

Borgerding L. A. & M. Dagistan (2018). Preservice Science Teachers' Concerns and Approaches for Teaching Socioscientific and Controversial Issues, *Journal of Science Teacher Education.*

Brent S., Draper N., Hodgson C. & Blackwell G. (2009) Development of a performance assessment tool for rock climbers, European Journal of Sport Science, 9(3), p. 159-167

Bromham, Lindell & O. Paolo, (2006). Evolution Online. Using A Virtual Learning Environment To Develop Active Learning In Undergraduates, *Journal of Biological Education,* 41(1). *21-25.*

Brooks S., Dobbins K., Scott J. J., Rawlinson M., & Norman R. I., (2014). Learning about learning outcomes: the student perspective, *Teaching in Higher Education,* 19(6) 721-733

Brown A., & Green, T. (2018). Issues and trends in instructional technology: consistent growth in online learning, digital content, and the use of mobile technologies. In *Educational Media and Technology Yearbook* (pp. 61–71).

Brown, L. (2014). Constructivist learning environments and defining the online learning community. *I-Manager's Journal on School Educational Technology*, 9(4). 1–6.

Burden, K., & Kearney, M. (2016). Future scenarios for mobile science learning. *Research in Science Education*, 46(2). 287–308.

Burian & Richard. M, (2013). On gene concepts and teaching genetics: Episodes from classical genetics. *Science & Education,* 22(2). 325–344.

Camus M, Hurtnicole E., Larsonlincoln R. & Prevostluanna, (2016). Facebook as an Online Teaching Tool. Effects on Student Participation, *Learning, and Overall Course Performance, College Teaching,* 64(2). *84-94.*

Cann A. J, Jane C.E, Karine M.L., & Kevin G. M.T, (2006). Assessed Online Discussion Groups in Biology education, *Bioscience Education,* 8(1). 1-11.

Cansoy & Ramazan, (2017). Examining The Relationship Between Pre-Service Teachers' Critical Thinking Disposition, Problem Solving Skills and Teacher Self-Efficacy. *International Education Studies;* 10(6).Issn 1913-9020 E-Issn 1913-

Cantor, A., Hippman, C., Hercher, L., & Austin, J. C. (2019). Genetic counseling students' experiences with mental illness during training: An exploratory study. *Journal of American College Health*, 67(4). 348–356.

Cardona, Ta Nia, Da S, (2007). Introducing DNA Concepts to Swiss High School Students Based on a Brazilian Educational Game, *Biochemistry And Molecular Biology Education,* 35(6). *Pp. 416–421*

Carlgren & Terresa, (2013). Communication, Critical Thinking, Problem Solving a Suggested Course for All High School Students in The 21st *Century. Interchange,* 44. 63–81

Cavallo, A. M. L., (1996). Meaningful learning, reasoning ability, and students' understanding and problem solving of topics in genetics. Journal of Research in Science Teaching, 33(6). 625–656.

Cebesoy, & Oztekin, C. (2018). Genetics literacy: Insights from science teachers' knowledge, attitude, and teaching perceptions. *International Journal of Science and Mathematics Education*, 16(7). 1247–1268.

Cebesoy, & Tekkaya, C. (2012). Pre-service science teachers' genetic literacy level and attitudes towards genetics. *Procedia - Social and Behavioral Sciences*, 31, 56–60.

Cetinkaya & Levent., (2017). An Educational Technology Tool That Developed in The Natural Flow of Life Among Students; Whatsapp, *International Journal of Progressive Education,* 13(2).

Cha S, & Ching S, (2014). Assessing Multidimensional Students' Perceptions of twenty-First-Century Learning Practices, *Asia Pacific Educ. Rev*.

Charalambos V., & Richard M. Z. C., (2004). The Design of Online Learning Communities. Critical Issues, *Educational Media International*

Chattopadhyay, A. (2005). Understanding of genetic information in higher secondary students in northeast India and the implications for genetics education. *Cell Biology Education*, *4*(1). 97–104.

Chatzigeorgiou, Theodorou A., Violettas T. L., Xinogalos G. E., Stelios, (2015). Blending an Android Development Course with Software Engineering Concepts. *Educ Inf Technol.*

Chigona & Agnes, (2013). Using Multimedia Technology to Build a Community of Practice. Pre-Service Teachers' and Digital Storytelling in South Africa. *International Journal of Education and Development Using Information and Communication Technology (Ijedict).* 9(3). *Pp. 17-27*

Childs A, Sorensen P, & Twidle J., (2011). Using the Internet in science teaching? Issues and challenges for initial teacher education *Technology, Pedagogy and Education* 20(2). 143-160

Chowning, J. T., Griswold, J. C., Kovarik, D. N., & Collins, L. J. (2012). Fostering critical thinking, reasoning, and argumentation skills through bioethics education. *PLoS ONE*, *7*(5). e36791.

Christopher, Julie A M. M.T., & Tallent K. M. R, (2004). Raising the Bar. Encouraging High level Thinking in Online Discussion Forums, *Roeper Review*, 26(3). *166-171*,

Chung L.S, Raymond, C, Wing S and Hew K.F (2011). Critical Thinking in Asynchronous Online Discussion: An Investigation of Student Facilitation Techniques. *National Institute of Education* Singapore

Cochrane & & Robert, (2015). Activities and Reflection for Influencing Beliefs about Learning with Smartphones, *EUROCALL Conference, Padova, Italy (Pp. 138-143)*

Concannon, J. P., Siegel, M. A., Halverson, K., & Freyermuth, S. (2010). College students' conceptions of stem cells, stem cell research, and cloning. *Journal of Science Education and Technology*, 19(2). 177–186.

Conderman G., (2016) How To Collaborate Through Teams, *Kappa Delta Pirecord*, 52(2). *71-75*,

Condy J, Agnes C, Daniela G & Eunice I., (2012) Pre-service Students Perceptions and Experriences of Digital Storytelling in Diverse Classrooms. *TOJET: The Turkish Online Journal of Educational Technology*

Connely & Thomas, (2009). *A New Biology for The 21st Century*. Washington. DC. National Academy of Sciences. All Rights Reserved

Conole, G. & Fill, K. (2005). A Learning Design Toolkit to Create Pedagogically Effective Learning Activities. *Journal of Interactive Media in Education (08).*

Cooling, T. (2012). What is a controversial issue? Implications for the treatment of religious beliefs in education. *Journal of Beliefs & Values*, 33(2). 169–181.

Cooner T S, Knowles A & Stout B., (2016). Creating a mobile app to teach ethical social media practices. *Social Work Education* 35(3). 245-259

Copping & Adrian, (2016). Exploring Connections between Creative thinking and Higher Attaining Writing, *Education*, 3(13).

Crompton H, Olszewki B., & Bielefieldt T., (2015). The mobile learning training needs of educators in technology-enabled environments. *Professional Development in Education* 42(3) 482-501

Cross T. & Palase. K, (2015). Increasing Learning. Classroom Assessment techniques In The Online Classroom, *American Journal of Distance Education*, 29(2). *98-108*,

Cush, D., & Robinson, C. (2014). Developments in religious studies: towards a dialogue with religious education. *British Journal of Religious Education, 36*(1). 4–17.

Darabia, Jin A., & Li, (2013). Improving The Quality of Online Discussion. The Effects of Strategies Designed Based on Cognitive Load Theory Principles, *Distance Education*, 34(1). 21–36,

De Wever, Valcke T. S., & Van Keer H., (2006). Content Analysis Schemes to Analyze Transcripts of Online Asynchronous Discussion Groups. A Review. *Computers and Education*, 46, *6-28.*

Demir Kadir, & Akpinarercan, (2018). The Effect of Mobile Learning Applications on Students' Academic Achievement and Attitudes Toward Mobile Learning, *Malaysian Online Journal of Educational Technology*, 6(2)

Dennis, & Liu. (2007). Potent Cells, *Cbe—Life Sciences Education* 6, *90 –94*

Doering, A., Veletsianos, G., Scharber, C., & Miller, C. (2009). Using the technological, pedagogical, and content knowledge framework to design online learning environments and professional development. *Journal of Educational Computing Research*, 41(3). 319–346.

Donovan, L., Green, T. D., & Mason, C. (2014). Examining the 21st century classroom: Developing an innovation configuration map. *Journal of Educational Computing Research*, *50*(2). 161–178

Dubuclet K S., Louyiping & M. Kim, (2015). Design and Cognitive Level of Student Dialogue In Secondary School Online Courses, *American Journal Of Distance Education*, 29(4). *283-296*,

Duncan, Goldan R, Faix, Castro M. & Jinnie C., (2015). Informing a Learning Progression in Genetics. Whichshould Be Taught First, Mendelian Inheritance or The Central Dogma of Molecular Biology? *International Journal of Science and Mathematics Education 2015*

Duncan, R. G., Freidenreich, H. B., Chinn, C. A, & Bausch, A. (in press). Promoting middle school students' understanding of molecular genetics. *Research in Science Education.*

Dyment, Janet E. & Jane D. J., (2019). Online Initial Teacher Education. A Systematic Review of The Literature, *Asia-Pacific Journal of Teacher* Education.

Ebrahimi, Faghih A., Esmail, Moghaddam, & Dabir M., (2016). Student Perceptions of Effective Discussion in Online Forums. A Case Study of Pre-Service Teachers, *Innovations In Education and Teaching International.*

Edens & Kellah M., (2000). Preparing Problem Solvers for The 21st century Through Problem-Based Learning, *College Teaching*, 48(2). 55-60.

Ejikeme, Anthonia N, & Helen (2016). Promoting Children's Learning Through Technology literacy. Challenges to School Librarians in The 21st Century. *Educ Inf Technol*

Elias, T. (2010). Universal instructional design principles for Moodle. *The International Review of Research in Open and Distributed Learning*, 11(2). 110.

Ellis, T. J., & Yair L. (2010). A guide for novice researchers: design and development research methods. In *Proceedings of Informing Science & IT Education Conference* (pp. 107–118).

Elo S. & Kyngas H., (2008). The Qualitative Content Analysis Process. *Journal of Advanced Nursing* 62(*1). 107–115*

Enochsson & Ann-Britt, (2017). Reflective Discussions in Teacher Training. A Comparison between Online and Offline Discussions of Course Literature in A Class of Pre-Service Teachers. *Educ Inf Technol*.

Erci K. & María E. O., (2016). In Search of Validity Evidencein Support of The Interpretation and Use of Assessments of Complex Constructs. Discussion of Research on Assessing 21st Century Skills, *Applied Measurement In Education*,

Espey & Molly, (2017). Enhancing Critical Thinking Using Team-Based Learning, *Higher Education Research and Development.*

Facione N C. & Facione P A., (1996). Externalizing The Critical Thinking in Clinical Judgment. *Nursing Outlook.*

Facione, P. A. (1990). *Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction*. Retrieved from https://philarchive. org/archive/FACCTA

Facione P. A, Giancarlo C. A., Facione N. C., (1994). Are College Students Disposed to Think? *American Educational Research Association*, New Orleans, Louisiana

Facione P. A, Giancarlo C. A., N. C. Facione, & Gainen J., (1995). The Disposition toward Critical Thinking. *Journal of General Education*. 44 (1). 1-25.

Facione, P., Facione, N and Giancarlo, C (1996). *The motivation to think in working and learning* In E. Jones (Ed.). *Defining Expectations for Student Learning* (San Francisco, CA: Jossey- Bass Inc.)

Facione P. A., Facione N. C., Giancarlo C. A. F., (1997). *Professional Judgment and the Disposition Toward Critical Thinking,* The California Academic Press, 217 La Cruz Ave., Millbrae, CA

Facione. P. A., (2000). *The Disposition Toward Critical Thinking. Its Character, Measurement, and Relationship to Critical Thinking Skill, lnformal Logic*, 20(1). pp. 61-84

Facione, P. A. (2011). *Critical thinking: What it is and why it counts. Insight assessment*. *Insight assessment*. Retrieved from https://www.kritischdenkenhbo.nl/files/uploads/2019/ 1566550466789-what & why criticalthinking, update 2015.pdf

Fattah & El Said Abdul S. F., (2015). The Effectiveness of Using Whatsapp, Messenger As One of Mobile Learning Techniques to Develop Students' Writing Skills, *Journal of Education and Practice*, 6(32)

Feola, E. I. (2016). Digital Literacy and New Technological Perspectives. *Universal Journal of Educational Research*, 4(9). 2174–2180.

Fink, R. D. (2002). Cloning, stem cells, and the current national debate: Incorporating ethics into a large introductory biology course. *Cell Biology Education*, 1(4). 132–144.

Flowers J & Cotton. S. E., (2007). Impacts of Student categorization of their Online Discussion Contributions, *American Journal of Distance education,* 21(2). 93-104.

Freidenreich, H. B., Duncan, R. G., & Shea, N. (2011). Exploring middle school students' understanding of three conceptual models in genetics. *International Journal of Science Education*, 33(17). 2323–2349.

Friedel, Irani C. R., T. A. Rhoades, E. B. Fuhrman, Nicholas E. Gallo, & Maria. (2008). It's In The Genes. Exploring Relationships Between Critical Thinking and Problem Solving In Undergraduate Agriscience Students' Solutions To Problems In Mendelian Genetics. *Journal of Agricultural Education,* 49(4).

Garvey, G. P. (2015). Fostering 21st century skill through game design and development. *12th International Conference on Cognition and Exploratory Learning in Digital Age (CELDA)* (pp. 385–386).

Gendik N., Hanci K., Engin K., C. Kursat, (2012). Key Instructional Design Issues In a Cellular Phone-Based Mobile Learning Project. *Computers and Education* 58 1149–1159

Gendik, N., Kiraz, E., & Ozden, M. Y. (2013). Design of a Blended Learning Environment: Considerations and Implementation Issues. *Australasian Journal of Educational Technology*, 29(1). 1–19.

Gericke, N., Carver, R., Castéra, J., Evangelista, N. A. M., Marre, C. C., & El-Hani, C. N. (2017). Exploring relationships among belief in genetic determinism, genetics knowledge, and social factors. *Science & Education*, 26(10). 1223–1259.

Gooden, Rebecca J., Winefield, & Helen R., (2007). Breast and Prostate Cancer Online Discussion Boards. A Thematic Analysis of Gender Differences and Similarities, *J Health Psychol 12 . 103*

Goodfellow R. (2011). Literacy, literacies and the digital in higher education, *Teaching in Higher Education* 16(1)

Gottheiner, D. M., & Siegel, M. A. (2012). Experienced middle school science teachers' assessment literacy: Investigating knowledge of students' conceptions in genetics and ways to shape instruction. *Journal of Science Teacher Education*, 23(5). 531–557.

Greav E, Claire B. & Debbie H., (2012). Learning Journeys. Exploring Approaches to Learner Digital Literacy Acquisition, *Enhancing Learning in The Social Sciences*, 4(2). 1-17.

Gressick J & Sharon D.J., (2010). Distributed Leadership in Online Groups, *Computer-Supported Collaborative Learning* 5.*211–236.*

Gretter S., (2016). Computational Thinking and Media and Information Literacy. An Integrated Approach to Teaching Twenty-First Century Skills, *Techtrends*

Gromik, & Nicholas. A. (2015). The Effect of Smartphone Video Camera as a Tool to Create Gigital Stories for English Learning Purposes, *Journal of Education and Learning;* 4(4).

Gros, Begoña, Peñalvo, & García F. J., (2016). Future Trends in The Design Strategies and Technological Affordances of E-Learning. *In M. Spector, B. B. Lockee, & M. D. Childress (Eds.). Learning, Design, and Technology. An International Compendium of Theory, Research, Practice, and Policy (Pp. 1-23)*

Gungor & Nur S., (2017). Evaluation of The Concepts and Subjects in Biology Perceived to Be Difficult to Learn and Teach by The Pre-Service Teachers Registered In The Pedagogical Formation Program. *European Journal of Educational Research* 6(4). 495 – 508

Hagop A. Y. & Khishfe R., (2018). Argumentation, Critical Thinking, Nature of Science and Socio scientific Issues. A Dialogue Between Two Researchers, *International Journal of Science Education*,

Häkkinen, P., Järvelä, S., Mäkitalo-Siegl, K., Ahonen, A., Näykki, P., & Valtonen, T. (2017). Preparing teacher-students for twenty-first-century learning practices (PREP 21): a framework for enhancing collaborative problem-solving and strategic learning skills. *Teachers and Teaching*, 23(1). 25–41.

Hambacher E, Katherine G., & Kathryn S., (2018). From Serial Monologue to Deep Dialogue. Designing Online Discussions to Facilitate Student Learning in Teacher Education Courses, *Action in Teacher Education,* 40(3). 239-252,

Haskel-Ittah, M., & Yarden, A. (2018). Students' Conception of Genetic Phenomena and its Effect on Their Ability to Understand the Underlying Mechanism. *CBE—Life Sciences Education*, 17(3). 1–9.

Haukenes, A. (2004). Perceived health risks and perceptions of expert consensus in modern food society. *Journal of Risk Research*, *7*(7–8). 759–774.

Hedberg J. G. (2014). Extending The Pedagogy of Mobility, *Educational Media International,* 51(3). *237-253.*

Helen & Boholano, (2017). Smart Social Networking 21st Century Teaching and Learning skill. *Research in Pedagogy, 7*(1). 21–29.

Holmes, Nguyen W, Mavrikis Q., Manolis J. Z. & Bart R., (2019). Learning Analytics for Learning Design in Online Distance Learning, *Distance Education*.

Hulme, Kukulska A. & Sharples M., (2009). Mobile and Contextual Learning, *ALT-J Research in Learning Technology,* 17(3)..

Hungmin L., Chien C., Hsiu C. C., Yuan O. Z., (2010). Learner Readiness for Online Learning. Scale Development and Student Perceptions. *Computers and Education* 55 *1080–1090*

Huxham M., Campbell F. & W. Jenny, (2012). Oral Versus Written assessments. A Test of Student Performance and Attitudes, *Assessment & Evaluation in Higher Education,* 37(1). *125-136,*

Iredale, Stapleford A., Tremayne K., Farrell D., Holbrey L, Christine & Sheridan J, (2019). A Review and Synthesis of The Use of Social Media in Initial Teacher Education, *Technology, Pedagogy and Education,*

Jansen & Cecelia, (2015). Teaching Practice in The 21st Century. Emerging Trends, Challenges and Opportunities, *College of Education, Unisa, 1-10*

Jeong A. C., (2003). The Sequential Analysis of Group Interaction and Critical Thinking In Online Threaded Discussions, *The American Journal of Distance Education,* 17(1). 25–43

Jiménez-Aleixandre, M. P. (2014). Determinism and Under Determination in Genetics: Implications for Students' Engagement in Argumentation and Epistemic Practices. *Science & Education,* 23(2). 465–484.

John L., Connely C., Oldham E., Marshall K., & B. Tangney (2018). Bridge 21. Teamwork, Technology and Learning. A Pragmatic Model For Effective Twenty-First-Century Team-Based Learning, *Technology, Pedagogy and Education*.

Johnson & Scott. D., (2000). Comparative Analysis of Learner Satisfaction and Learning Outcomes in Online Face-to-Face Learning Envitonment. *Journal of Interactive Learning Reasearch,* 11(1). 29-49.

Kaliisa R. & Picardmichelle, (2017). A Systematic Review on Mobile Learning in Higher Education. The African Perspective, *The Turkish Online Journal of Educational Technology,* 16(1).

Kanthawongs & Penjira, (2016). An Empirical Study on The Impact of Self-Regulation and Compulsivity toward Smartphone Addiction of University student, *13th International Conference On Cognition and Exploratory Learning In Digital Age, 339- 342*

Karagoz, Meryem. Cakir, & Mustafa. (2011). Problem Solving In Genetics. Conceptual and Procedural Difficulties. *Educational Sciences. Theory*

Karakoyun, Ferit, (2016). The Investigation of Preservice Teachers' and Primary School Students' Views about Online Digital Storytelling, *European Journal of Contem-porary Education,* 15(1). Pp. 51-64.

Katzan H., (2015). Principles of Tablet Computing for Educators, *Contemporary Issues in Education Research – First Quarter,* 8(1).

Kay H. L.Tan, Sabine & E. Marissa K.L. (2015) Multimodal Analysis for Critical Thinking, *Learning, Media and Technology.*

Keane, Therese, (2014). Beyond Traditional Literacy. Learning and Transformative Practices Using ICT. *Educ Inf Technol.*

Kee Ch'ng, L. Samsudin, Zarina, (2014). Mobile Devices Toys or Learning Tools for 21st Century Teenager, *TOJET. The Turkish Online. Journal of Educational Technology* –13 (3)

Keenan, Presti M., Giovambattista, & Karola D., (2019). Technology and Behaviour Analysis in Higher Education, *European Journal of Behavior Analysis,*

Kehrwald, Benjamin. (2010). Being Online. Social Presence as Subjectivity in Online Learning, *London Review of Education,* 8(1). 39–50

Kellah M. E. (2000). Preparing Problem Solvers for the 21st Century through Problem-Based Learning, *College Teaching,* 48:2, 55-60.

Kendal, S., Kirk, S., Elvey, R., Catchpole, R., & Pryjmachuk, S. (2017). How a Moderated Online Discussion Forum Facilitates Support for Young People with Eating Disorders. *Health Expectations*, 20(1). 98–111.

Keskin, & Özer M., (2013). Argumentation Based Bioethics Education. Sample Implementation on Genetically Modified Organisms (GMOs) and Genetic Screening Tests, *Academic Jurnal,* 8(16*). Pp. 1383-1391,*

Kılıç, D., & Sağlam, N. (2014). Students' understanding of genetics concepts: the effect of reasoning ability and learning approaches. *Journal of Biological Education*, 48(2). 63–70.

Kim S, Kim H and Han S., (2013). A Development of Learning Widget on M-learning and E-learning Environments. *Behaviour & Information Technology,* 32(2) 190-202

Kim, Ketenci M. K., Tuba, (2019). The Role of Expresse Demotions in Online Discussions, *Journal of Research on Technology in Education,*

Kisakas T., (2017). Peer Critique Using The Discussion Forum. A Case of Two Honours Students, *International Journal of Educational Sciences,* 19(1). 42-53,

Kivunja, C. (2013). Embedding Digital Pedagogy in Pre-Service Higher Education to Better Prepare Teachers for The Digital Generation, *International Journal of Higher Education.* 2(4)

Kivunja, C. (2014). Innovative Pedagogies in Higher Education to Become Effective Teachers of 21st Century Skills. Unpacking The Learning and Innovations Skills Domain of The New Learning Paradigm, *International Journal of Higher Education.* 3(4)

Kivunja, C. (2015). Teaching students to learn and to work well with 21st century skills: unpacking the career and life skills domain of the new learning paradigm. *International Journal of Higher Education*, 4(1)

Klimczak, Rose M. Marra Joi L. Moore Aimee K. (2004). Content Analysis of Online Discussion Forums. *A Comparative Analysis of Protocols*, 52(2). Pp. 23–40.

Knippels M. P. J., Waarlo A. J. & Boersma K.T. (2005). Design criteria for learning and teaching genetics**.** *Journal of Biological Education*. 39(3).

Koroleva, D.O. (2018). Potential for Using Mobile and Networking Technologies in Teaching, *Russian Education and Society,* 60(5). 422-438,

Koszalka, Tiffany A. Kuswani G.S., & Ntloedibe, (2010). Literature on The Safe and Disruptive Learning Potential of Mobile Technologies, *Distance Education,* 31(2). 139–157

Kuhn, (2016). Learning is The Key Twenty-First Century Skill, *Learning Research and Practice.*

Kuo & Yu-Chun, (2014). Accelerated Online Learning. Perceptions of Interaction and Learning Outcomes Among African American Students, *American Journal of Distance Education,* 28(4). 241-252.

Kurilovas E., Cieneanita J. & Virginija B., (2015). Research on Mobile Learning activities Applying Tablets, *ISBN. 978-989-8533-36-4*

Kurniawan I S, Tapilow F S, & Hidayat T. (2017). How can Smartphone-Based Internet Data Support Animal Ecology Fieldtrip? *Journal of Physics: Conference Series*, Volume 895.

Kwon K., Park Su Jin, Suhkyung S, & Young C. C., (2019). Effects of Different Types of Instructor Comments in Online Discussions, *Distance Education,* 40(2). 226-242.

la Velle L., (2013). ICT, Teaching and Learning: What do The Latest Mobile Technologies afford? *Journal of Biological Education* 71-72

Lai K., (2012). Assessing Participation Skills. Online Discussions with Peers, *Assessment & Evaluation in Higher Education,* 37(8). 933-947.

Landis M., Swain K. D., & Friehe M. J., & Coufal K. L., (2007). Evaluating Critical Thinking in Class and Online. Comparison of the Newman Method and the Facione Rubric. *Communication Disorders Quarterly,* 28(3).

Lanie, A. D., Jayaratne, T. B., Sheldon, J. P., Kardia, S. L. R., Anderson, E. S., Feldbaum, M., & Petty, E. M. (2004). Exploring the Public Understanding of Basic Genetic Concepts. *Journal of Genetic Counseling,* 13(4). 305–319.

Lawlor J, Conneely C, Oldham E, Marshall K &Tangney B., (2018). Bridge21: Teamwork, technology and learning A pragmatic model for effective twenty-first-century team-based learning *Technology, Pedagogy and Education,* 27(2). 211-232.

Lee S W, Tsai C C, Wu Y T, Tsai M J, Liu T C, Hwang F K, Li C H, Liang J C, Wu H C & Chang C Y., (2011) Internet-based Science Learning: A review of journal publications *International Journal of Science Education* 33(14). 1893-1925

Lee Y H., (2017) Scripting to enhance university students' critical thinking in flipped learning: implications of the delayed effect on science reading literacy *Interactive Learning Environments,* 26(5). 569-582

Lee, & Jieun, (2008). Rating Scales for Interpreting Performance Assessment, *The interpreter and Translator Trainer,* 2(2). 165-184,

Lencastre A. De, (2017). An Investigative Graduate Laboratory Course for Teaching Modern DNA Techniques, *Biochemistry and Molecular Biology Education,*

Lewis, J., & Kattmann, U. (2004). Traits, genes, particles and information: Re-visiting students' understandings of genetics. *International Journal of Science Education,* 26(2). 195–206.

Lewis, J., & Wood-Robinson, C. (2000). Genes, chromosomes, cell division and inheritance—Do students see any relationship? *International Journal of Science Education,* 22(2). 177–195.

Lewis, J., Leach, J., & Wood-Robinson, C. (2000). Chromosomes: The missing link—Young people's understanding of mitosis, meiosis and fertilization. *Journal of Biological Education,* 34(4). 189–199.

Library of Congress Cataloging in Publication Data, (2008). Teaching and learning in higher education, A handbook for teaching and learning in higher education: enhancing academic practice, edited 3rd ed,.LB2331.H3145 2008, 378,125–dc222008009873

Liu, X. Li, Lan & Z, Zhihong, (2017). Small Group Discussionas a Key Component in Online Assessment Training for Enhanced Student Learning in web-Based Peer Assessment, *Assessment and Evaluation In Higher Education,*

Luterbach, K. J., & Brown, C. (2011). Education for the 21st century. *International Journal of Applied Educational Studies*, 11(1). 14–32.

Macdonald, & J. Andcreanorlinda, (2010). Learning With Online and *Mobile Technologies A Student Surviva Guide*. USA. Gower Publishing Company

Mahon & Caren. (2014). *Creating A Content Strategy for Mobile Devices.* U.S. Department of Education in The Classroom

Mamdour & Nasser. (2010). Science Teachers' Interpretations of Islamic Culture Related to Science Education Versus The Islamic Epistemology and Ontology of Science, *Cult Stud Of Sci Educ*, 5, 127–140

Mangahas, A. M. E. (2017). Perceptions of high school biology teachers in christian schools on relationships between religious beliefs and teaching evolution. *Journal of Research on Christian Education*, 26(1). 24–43.

Mansour, N. (2010). Science teachers' interpretations of Islamic culture related to science education versus the Islamic epistemology and ontology of science. *Cultural Studies of Science Education*, *5*(1). 127–140.

Marbach-Ad, G., & Stavy, R. (2000). Students' cellular and molecular explanations of genetics phenomena. *Journal of Biological Education*, 34(4). 200–205.

Maryuningsih, Y., Hidayat, T., Riandi, R., & Rustaman, N., (2018). Penerapan analogi pada perkuliahan genetika untuk menumbuhkan keterampilan penalaran ilmiah (scientific reasoning). *JURNAL BIOEDUKATIKA*, 6(2). 59.

Maryuningsih Y, Hidayat T, Riandi R and Rustaman N., (2019). Critical thinking skills of prospective biology teacher on the chromosomal basic of inheritance learning through online discussion forums, *Journal of Physics: Conference Series* 1157 2 022090

Maryuningsih, Y., Hidayat, T., Riandi, R., & Rustaman, N. (2019). Developing Gen-21cs on smartphone to cultivate the 21st-century skills on biology teacher candidates. *JPBI (Jurnal Pendidikan Biologi Indonesia). 5*(3). 415–424.

Maryuningsih, Y., Hidayat, T., Riandi, R., & Rustaman, N. (2020). The critical thinking skills of biology teacher candidates toward the ethical issues. *JPBI (Jurnal Pendidikan Biologi Indonesia).* 6(1). 65-74.

Maryuningsih, Y., Hidayat, T., Riandi, R., & Rustaman, N. (2020). Profile of information and communication technologies (ICT) skills of prospective teachers, *Journal of Physics: Conference Series* 1521 1521 042009.

Maryuningsih, Y., Hidayat, T., Riandi, R., & Rustaman, N. (2020). Contribution of internet resources to mastery genetic concept on prospective teachers, *Journal of Physics: Conference Series* 1521 042010.

Maryuningsih, Y., Hidayat, T., Riandi, R., & Rustaman, N., (2020). Developing performance assessment instruments to measure 4C skills in online discussion activities of science learning. *Jurnal Scientiae Educatia: Jurnal Pendidikan Sains* Jilid 9(1) p. 209-220.

Mathesona. R, Wilkinsonb. S. C & Gilhoolyc. E., (2012). Promoting Critical Thinking and Collaborative Working Through assessment. Combining Patchwork Text and Online Discussion boards. *Innovations in Education and Teaching International*, 49(3). 257–267.

Mayberry, John, (2012). Exploring Teaching and Learning Using an Itouch Mobile Device. *Active Learning In Higher Education*, 13(3). *203 –217*

Mccarthy J., (2018). Do Creative Thinking and Creative problem solving Have a Place in Counseling Curricula? *Journal of Creativity in Mental health*,

McDougall J, Readman M & Wilkinson P., (2018). The uses of digital literacy, Learning, Media and Technology, 43(3). 263-279.

Mcloughlin D. & Mynard J, (2009). An Analysis of Higher Order Thinking In online Discussions, *Innovations In Education And Teaching International*, 46(2).147-160

Megan K., Yih Chyn A. Huijser, & Henk, (2011). The Power of Problem-Based Learning in Developing Critical Thinking Skills. Preparing Students for Tomorrow's Digital Futures In Today's Classrooms, *Higher Education Research dan Development,* 30(3)

Meltzer D. E. (2002). The relationship between mathematics preparation and conceptual learning gains in physics: A possible ''hidden variable'' in diagnostic pretest scores. *American Association of Physics Teachers.* Am. J. Phys. 70 ~12.

Mnkandla & Ernest, (2017). The Use of Social Media in E-Learning. A Metasynthesis, *International Review of Research in Open and Distributed Learning,* 18(5)

Mohamad, Maslawati, Shaharuddin, & Shahizan, (2014). Online Forum Discussion to Promote Sense of Learning Community among The Group Members. *International Education Studies;* 7(13).

Molly E., (2017) Enhancing Critical Thinking Using Team-Based Learning, *Higher Education Research and Development.*

Moorejoi L, Dickson D. C., & Krista G., (2010). E-Learning, Online Learning, and Distance Learning Environments. Are They The Same? *Internet and Higher Education.*

Morris, Neil P., (2010). Podcasts and Mobile Assessment Enhance Student Learning Experience and Academic Performance, *Bioscience Education, 16.1, 1-7.*

Muchnik, P. (2018). Clipping our dogmatic wings: The role of religion's Parerga in our moral education. *Educational Philosophy and Theory*, *51*(13). 1381–1391.

Muisedaniel & Panjennifer, (2018). Online Field Experiments, *Asian Journal of Communication*.

Nacudenise C, Martincaitlin K, Pinkardnichole & Graytené, (2014). Analyzing Educators' Online Interactions. a Framework of Online Learning Support Roles, *Learning, Media and Technology.*

Nair T., & Bindu R L, (2016). Effect of Blended Learning Strategy on Achievement in Biology and Social and Environmental Attitude of Students at Secondary Level, I-Manager'S, *Journal on School Educational Technology*, 11(4)

Nandidip H., & James H., (2012). Evaluating The Quality of Interaction in Asynchronous Discussion Forums in Fully Online Courses, *Distance Education*, 33(1). 5-30.

Nandidip H., James H., & Warburtongeoff, (2011). How Active are Students in Online Discussion Forums? *Australian Computer Society, Inc*, 114. Pp 1-9.

Nedungadi P, & Ramanraghu, (2012). A New Approach to Personalization. Integrating E-Learning and M-Learning, *Education Tech Research Dev*, 60. 659–678

National Education Association. (2012). Preparing 21st century students for a global society: An educator's guide to the "Four Cs". Retrieved from http://www.nea.org/ assets/docs/A-Guide-to-Four-Cs.pdf

Nie, F. (2019). Religion and youth educational aspirations: A multilevel approach. *Journal of Beliefs & Values*, 40(1). 88–103.

Nitza & Davidivitch, (2016). Whatsapp Messaging. Achievements and Success in Academia, *International Journal of Higher Education*, 5(4)

Numbers & Ronald L. (2015). Gregor Mendel: Creationist Hero, *Science & Education*, 24 (1-2) p115-123

Olga V., Andersson A. & Wiklund M., (2018). Designing for Sustainable Mobile Learning – Re-Evaluating The Concepts "Formal" and "Informal", *Interactive Learning Environments*.

Oon-Seng Tan, (2003). *Problem-Based Learning Innovation: Using Problems to Power Learning in the 21st Century*, Cengage Learning Learning Asia Pte Ltd.5 Shenton Way #01-01 UIC Building. Singapore 068808

Oon-Seng Tan, (2004). *Enhancing Thinking Through Problem-Based Learning Approaches: International Perspectives*. 5 Shenton Way. #01-01 UIC Building, Singapore 068808

Oon-Seng Tan, (2009). *Problem-based Learning and Creativity*, Cengage Learning Asia Pte Ltd. 5 Shenton Way #01-0. UIC Building, Singapore 068808, ISBN-13: 978-981-4253-14-7. ISBN-10: 981-4253-14-6

O'reilly M., & Newton D., (2002). Interaction Online. Above and Beyond Requirements of Assessment', Australian *Journal of Educational Technology*, 18(1). *Pp. 57-70.*

Picciano A. G, (2001). Beyond Student Perceptions, Issues of Interaction, Presence, and Performance in an Online Course, *JALN* 6(1)

Piergio V. & Polly R., (2014) Creating a Critical Thinker, *College Teaching*, 62(3). *86-93*

Pilgrim, J., Elda, E., & Martinez. (2013). Defining literacy in the 21st century: a guide to terminology and skills. *Texas Journal of Literacy Education*, 1(1). 60–69.

Pillshane & Sueseebrendan, (2017). Including Critical Thinking and Problem solving in Physical Education, *Journal of Physical Education, Recreation and Dance*, 88(9). 43-49.

Pirojody S. & Andersongina, (2018). Intentional Online Discussions in Teacher Education, *The Teacher Educator, 53.2, 167-189,*

Podoprigora, R. (2018). School and religion in Kazakhstan: No choice for believers. *Journal of School Choice*, 12(4). 588–604.

Poromaa P I., (2013). ICT practices, social class and pedagogy in Swedish lower secondary schools *Education Inquiry*, 4(4).

Quadir, Yang B., Jie Chi, & Shing Chen N., (2019). The Effects of interaction Types on Learning Outcomes In A Blog-Based Interactive Learning Environment, *Interactive Learning Environments,*

Quieng, Marjorie C, (2015). 21st Century-Based Soft Skills. Spotlight on Non-Cognitive Skills in A Cognitive-Laden Dentistry Program, *European Journal Of Contemporary Education,* 11(1).

Quinn, Cook E. D., Alexandria, & Charity R., (2019). An Online community of Practice to Improve Intervention for Individuals with Complex Communication Needs, *Augmentative and Alternative Communication*.

Ragusa A T & Crampton A., (2018). Sense of connection, identity and academic success in distance education: Sociologically exploring online learning environment *Rural Society* 27(2). 125-142

Raish, Victoria & Anne B., (2018). Library Connection. An Interactive, Personalized Orientation for Online Students, *Journal of Library and Information Services In Distance learning.*

Reeves T. C, Jan H., Ron O., (2002). Authentic Activities and Online Learning.

Revilla M O, Alpiste P F & Fernández S J., (2016). The skills, competences, and attitude toward information and communications technology recommender system: an online support program for teachers with personalized recommendations *New Review of Hypermedia and Multimedia* 22 1-2 83-110

Riadi E. (2018). *Statistik SEM (Structural Equation Modeling dengan LISREL*. Penerbit CV ANDI. Yogyakarta

Richey R., & Klein, J. D., (2014). *Design and Development Research.* A Rose by another Name, Florida State University Paper Presented At Aera, Philadelphia, Paapril, 14.

Rismark M., Sølvber Gastrid M, Strøm Mealex, Martin H., (2007). Using Mobile Phone to Preparae for University Lectures. *Student Experiences*, 6(4).

Rooy & Wilhelmina S. Van (2012). Using Information and Communication Technology (ICT) To The Maximum. Learning And Teaching Biology With Limited Digital Technologies, *Research In Science dan Technological Education,* 30(1). 65–80

Rovai A. P. (2007). Facilitating Online Discussions Effectively. *Internet and Higher Education* 10, 77–88

Runnels M. K., & Tallent, (2006). Teaching Courses Online. A Review of The Research, *Review of Educational Research* 76.1, *Pp. 93–135.*

Salehudin, S. N., & Iksan, Z. (2017). Integration of tauhid (faith) element in biology education. *Journal of Educational Science*, 1(1). 11–23.

Sans O, Cesareni N., Bortolotti D., Ilaria, & Sarah B., (2019). Teaching Technology-Mediated Collaborative Learning for Trainee Teachers, *Technology, Pedagogy and Education, 28.3, 381-394.*

Sarjaanneli, Janhonensirpa, Havukainenpirjo & Vesterinenanne, (2017). Towards Practical Reflexivity in Online Discussion Groups, *Teaching in Higher Education.*

Savin B. & Maggi, 2007, *A Practical guide to problem-based learning online,* Library of Congress Cataloging in Publication Data, Routledge 270 Madison Ave, New York

Schayan & Janet, (2001). Learning on The Internet, *European Education,* 33(4). 5-9.

Scully, J. L., Banks, S., Song, R., & Haq, J. (2017). Experiences of faith group members using new reproductive and genetic technologies: A qualitative interview study. *Human Fertility*, 20(1). 22–29.

Seifert & Tami, (2004). Pedagogical applications of Smartphones Integration in Teaching- Lecturers, Student and Pupils Perspectives, *10th International Conference Mobile Learning,* 117-124

Selkrig M. & Keamykim R, (2017). Creative Pedagogy. A case For Teachers' Creative Learning Being at The Centre, *Teaching Education.*

Seta L, Hulme, Kukulska A. & Arrigomarco, (2013). What Have We Learnt About Mobile Lifelong Learning (Mlll)? *International Journal of Lifelong Education*.

Shai, S., & Shwartz. (2011). Online learning and online Convex optimization. *Foundations and Trends in Machine Learning*, *4*(2). 107–194.

Shavelson R. J. Z., Olga T., Klaus B., Susanne S. & Julian P M., (2019). Assessment of University Students' Critical thinking. Next Generation Performance Assessment, *International Journal of Testing*.

Shen, R., Wang, M., Gao, W., Novak, D., & Tang, L. (2009). Mobile learning in a large blended computer science classroom: System function, pedagogies, and their impact on learning. *IEEE Transactions on Education*, 52(4). 538–546.

Shin, D.-H., Shin, Y.-J., Choo, H., & Beom, K., (2011). Smartphones as smart pedagogical tools: Implications for smartphones as u-learning devices. *Computers in Human Behavior,* 27(*6). 2207–2214.*

Slavica B. Maksić & Spasenović V. Z., (2018). Educational Science students' Implicit Theories of Creativity, *Creativity Research Journal*, 30(3). 287-294.

So & Winnie W.M. (2012) Creating A Framework of A Resource-Based E-Learning environment For Science Learning In Primary Classrooms, *Technology, Pedagogy and Education, S21.3, 317-335.*

Spatariu A, Kendall H., & Bendixenlisa D. (2004). Defining and Measuring Quality in Online Discussions, *The Journal of Interactive Online Learning Volume 2, Number 4*

Stern, F., & Kampourakis, K. (2017). Teaching for genetics literacy in the post-genomic era. *Studies in Science Education*, *53*(2). 193–225.

Stevens, R. (2012). Identifying 21st century capabilities. *International Journal of Learning and Change*, 6(3/4). 123.

Stewart D.W. & Saniprem S., (2016). Online Focus Groups, *Journal of Advertising.*

Stewart, J., & Dale, M. (1989). High school students' understanding of chromosome/gene behavior during meiosis. *Science Education,* 73, 501–521.

Stewart, J., Hafner, B., & Dale, M. (1990). Students' alternate views of meiosis. *The American Biology Teacher, 52*(4). 228–232.

Sun, Z., Lin, C.-H., Wu, M., Zhou, J., & Luo, L. (2018). A tale of two communication tools: Discussion-forum and mobile instant-messaging apps in collaborative learning. *British Journal of Educational Technology,* 49(2). 248–261.

Sugiyono, Susanto, A., (2015). *Cara Mudah Belajar SPSS dan Lisrel, Teori dan aplikasi untuk Analisis Data Penelitian*, Penerbit Alfabeta Bandung

Sunghan-Yu & Changya-Chi H. J, (2013). Development of a Mobile Learning System Based on a Collaborative Problem-Posing Strategy, *Interactive Learning Environments*.

Susan R. & Cramer, (2007). Update Your Classroom With Learning Objects and Twenty-First-Century Skills, The Clearing House. *A Journal of Educational Strategies, Issues and Ideas,* 80(3). 126-132

Susan R. & Cramer Ph.D. (2007). Update Your Classroom with Learning Objects and Twenty- irst-Century Skills, The Clearing House: *A Journal of Educational Strategies, Issues and Ideas*, 0:3, 126-132.

Swart, R. (2017). Critical thinking instruction and technology enhanced learning from the student perspective: A mixed methods research study. *Nurse Education in Practice*, 23, 30–39.

Szabo, Zsuzsanna & Schwartz, J. (2011). Learning Methods for Teacher education. The use of Online Discussions to Improve Critical Thinking, *Technology, Pedagogy and education,* 20(1). 79-94.

Taylor A. T. S, (2011). The Ethical Implications of Genetic Testing in The Classroom, *Biochemistry and Molecular Biology Education*, 39(4). *Pp. 253–260*

Taylor J., Alexandra L. & Michael M., (2017). Talking About Sunbed Tanning in Online Discussion Forums. *Assertions and Arguments, Psychology and Health.*

Temel, & Senar, (2014). The Effects of Problem-Based Learning on Pre-Service Teachers'critical Thinking Dispositions and Perceptions of Problem-Solving ability. *South African Journal of Education;* 34(1)

Terit & Saskia, (2013). Student Use and Pedagogical Impact of A mobile Learning Application. *Biochemistry and Molecular Biology Education*, 121-135.

Thomas J.E & Charles G. R., (2018). Online Teaching Competencies in Observational Rubrics. What Are Institutions Evaluating? *Distance Education.*

Thomas Wang, Charles. (2013). Fostering critical religious thinking in multicultural education for teacher education. *Journal of Beliefs & Values*, 34(2). 152–164.

Tibi H M., (2018). Computer Science Students' Attitudes Towards The Use of Structured and Unstructured Discussion Forums in Online Courses. *Online Learning*, 22(1). 93-106.

Todd, A., & Kenyon, L. (2013). *Using learning progressions to map high school student understandings of molecular genetics*. https://corescholar. libraries.wright.edu/ med_ education/4

Todd, A., & Romine, W. L. (2017). Empirical validation of a modern genetics progression web for college biology students. *International Journal of Science Education*, 39(4). 488–505.

Todd, A., (2016). Development and Validation of The learning Progression–Based assessment of Modern Genetics in a high School Context. *Science education Inc. Sci Ed* 1–34

Tomi K., Keinänen H., Tuominen A., Hoikkala M., Matikainen E., & Maijala H., (2018). Meaningful Learning with Mobile Devices. Pre-Service Class Teachers' Experiences of Mobile Learning in The Outdoors, *Technology, Pedagogy and Education.*

Tracey, Monica W. (2007). Design and Development Research. A Model Validation case. *Education Tech Research*

Trilling B & Fadel C., (2009). 21st century skills: learning for life in our times, United States of America, ISBN 978-0-470-47538-6.

Tucker & Shelia Y, (2014). Transforming Pedagogies Integrating 21ST Century Skills and Web 2.0 Technology, *Turkish Online Journal of Distance Education-TOJDE* 15(1).

Tucker, J. P., Young Gonzaga, S., & Krause, J. (2014). A proposed model for authenticating knowledge transfer in online discussion forums. *International Journal of Higher Education*, 3(2). 106–119.

Tuckwell D. (2017). Still Educating Design Thinking, *Communication Design*, 5.(1-2). 131-144.

Twum R., (2017). Utilization of Smartphones in Science Teaching and Learning in Selected Universities in Ghana, *Journal of Education and Practice* 8(7).

Uijl, S., Filius, R., & Ten Cate, O. (2017). Student interaction in small private online courses. *Medical Science Educator*, 27(2). 237–242.

Uthermaria (2019) Mobile Learning—Trends and Practices, *Education Sciences* 9(33).

Vonderwell S, Xin L. & Kay A., (2007). Asynchronous Discussions and Assessment In Online Learning, *Journal of Research on Technology In Education,* 39(3). 309-328.

Walker P. & Nicholas F., (1999). Skill Development and Critical Thinking in Higher Education, *Teaching In Higher Education*, 4(4). 531-547.

Watts & Julie. (2019) Assessing an Online Student Orientation. Impacts on retention, Satisfaction, and Student Learning, *Technical Communication Quarterly*, 28(3). 254-270.

William S, & Ronald, (2011). Research Brief Digital Literacy, *EPI Education Partnership*.

Wilson & Mark, (2016). Assessment of Learning in Digital Interactive Social Networks. A Learning Analytics Approach, *Online Learning*, 20(2). 97-119

Wolf, Dahl T. J., Auen A., Colleen & Doherty M., (2015). The Reliability and Validity of The Complex Task Performance Assessment. A Performance-Based Assessment of Executive Function, *Neuropsychological rehabilitation. An International Journal.*

Wu & Hiltz (2004). Prediction Learning from Asyncronous Online Discussion, *JALN*, 8(2).

Yap, Siew Fang., (2014). Beliefs, Values, Ethics and Moral Reasoning in Socio-Scientific Education, *Issues in Educational Research*, 24(3*)*

Yin H. C., Chai C. S. & Toh Y., (2018). Traversing The Context of Professional Learning Communities. Development and Implementation of Technological Pedagogical Content Knowledge of A Primary Science Teacher, *Research In Science and Technological Education.*

Yoo D K & Cho S (2018). Role of Habit and Value Perceptions on m-Learning Outcomes *Journal of Computer Information Systems* 1(11).

Yukselturk E., (2010). An Investigation of Factors affecting Student Participation Level in an Online Discussion Forums, *The Turkish Online Journal of Educational Technology*, 9(2).

Zan & Nuray. (2015). The Effects of Smartphone Use on Organic Chemical Compound Learning, *US-China Education Review A,* 5(2). 105-113.

Zande P. V. Der, Arend J.W., Mieke B., A. Sanne F. & Vermunt Jan D., (2011). A Knowledge Base for Teaching Biology Situated in The Context of Genetic Testing, International, *Journal of Science Education,* 33(15). 2037-2067,

Zhu, & Erping, (2003). Interaction and Cognitive Engagement. An Analysis of Four Asynchronous Online Discussions, *Instructional Science.* 34. 451–480

Zhu, Herring M., Susan C., & Curtis J. B., (2019) Exploring Presence in online Learning Through Three Forms of Computer-Mediated Discourse Analysis, *Distance Education,* 40(2). 205-225.