

PROGRAM PERKULIAHAN BIOTEKNOLOGI BERMUATAN
BIOENTREPRENEURSHIP DAN BERBASIS SUMBER DAYA
LOKAL UNTUK MENINGKATKAN KETERAMPILAN BERPIKIR
KREATIF DAN SIKAP WIRAUSAHA MAHASISWA

DISERTASI

Diajukan untuk Memenuhi Sebagian dari Syarat Memperoleh Gelar Doktor
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BERPIKIR KREATIF DAN SIKAP WIRAUSAHA MAHASISWA**

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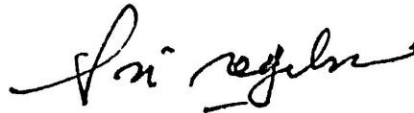
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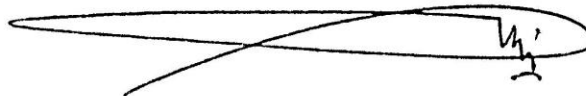
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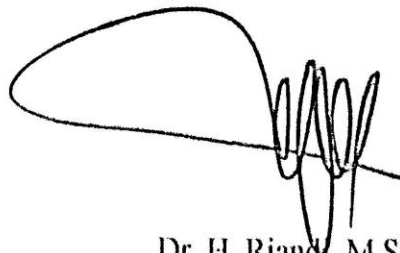
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ABSTRAK

Penelitian ini bertujuan untuk mengembangkan program perkuliahan yang mengintegrasikan antara bioteknologi dengan *entrepreneurship* yang memanfaatkan sumber daya lokal sehingga dapat meningkatkan keterampilan berpikir kreatif dan sikap wirausaha mahasiswa calon guru biologi, atau disingkat PB4SDL. Penelitian menggunakan *Research and Development* (R&D) yang meliputi empat tahap, yaitu studi pendahuluan, tahap perencanaan, tahap pengembangan, dan tahap implementasi. Subjek dalam penelitian ini adalah satu kelas mahasiswa semester V program studi Pendidikan Biologi pada tahun ajaran 2017/2018. Penelitian ini telah mengungkap karakteristik program PB4SDL yaitu terdiri dari empat fase pembelajaran ; mengajarkan pengetahuan, keterampilan dan sikap yang dibutuhkan bagi dilaksanakannya komersialisasi produk hayati; memanfaatkan sumber daya lokal; menghasilkan struktur kognitif yang mudah diproses menjadi ide; menghasilkan berbagai macam ide produk bioteknologi yang dapat diolah dari sumber daya lokal; menghasilkan produk bioteknologi nyata; dan membawa bioteknologi dari lingkungan akademik kepada masyarakat. Melalui analisis data diperoleh hasil bahwa program PB4SDL telah dapat meningkatkan keterampilan berpikir kreatif, sikap wirausaha, dan penguasaan konsep bioteknologi mahasiswa calon guru biologi dengan nilai peningkatan pada kategori sedang. Selain itu mahasiswa calon guru biologi juga telah mampu menciptakan produk bioteknologi yang kreatif berbahan baku sumber daya lokal yang baru, bermanfaat, dan hasil kombinasi berbagai unsur. Program PB4SDL memiliki keunggulan, yaitu menyediakan lingkungan belajar yang mendukung kegiatan *hands on* dan *minds on*, mendukung aktivitas akademik dan kewirausahaan, serta mengembangkan kemampuan dalam tiga ranah sekaligus, yaitu kognitif, afektif, dan psikomotorik. Keterbatasan program PB4SDL yaitu membutuhkan waktu yang lama dalam pelaksanaannya, serta belum menyediakan aktivitas kewirausahaan dengan skala yang lebih luas.

Kata Kunci : Bioteknologi, Bioentrepreneurship, Sumber Daya Lokal, Keterampilan Berpikir Kreatif, Sikap Wirausaha

BIOTECHNOLOGY COLLEGE EDUCATION PROGRAM WITH BIOENTREPRENEURSHIP BASED ON LOCAL RESOURCES TO IMPROVE CREATIVE THINKING SKILLS AND STUDENT ENTREPRENEURIAL ATTITUDES

ABSTRACT

This study aims to develop a lecture program that integrates biotechnology with entrepreneurship that utilizes local resources so that it can improve creative thinking skills and entrepreneurial attitudes of prospective biology teacher students, or abbreviated as PB4SDL. The Research uses *Research and Development* (R & D) which includes four stages, namely preliminary studies, planning stages, development stages, and implementation stages. The subjects in this study were one class of fifth semester students in the Biology Education study program of the 2017/2018 school year. This research has revealed the characteristics of the PB4SDL program which consists of four learning phases; teach the knowledge, skills and attitudes needed for the commercialization of biological products; utilize local resources; produce cognitive structures that are easily processed into ideas; produce various kinds of ideas for biotech products that can be processed from local resources; produce real biotechnology products; and bring biotechnology from the academic environment to the community. Through data analysis, the results showed that the PB4SDL program had been able to improve creative thinking skills, entrepreneurial attitudes, and mastery of the biotechnology concept of prospective biology teacher students with an increase in the moderate category. In addition, prospective biology teacher students have also been able to create creative biotechnology products based on new, useful, local resources and the combination of various elements. The PB4SDL program has the advantage of providing a learning environment that supports *hands on and minds on* activities, supports academic and entrepreneurial activities, and develops abilities in three domains at once, namely cognitive, affective, and psychomotor. The limitations of the PB4SDL program are that it takes a long time to implement, and has not provided entrepreneurial activities on a wider scale.

Keywords: Biotechnology, Bioentrepreneurship, Local Resources, Creative Thinking Skills, Entrepreneurial Attitudes

DAFTAR ISI

LEMBAR PERNYATAAN	i
KATA PENGANTAR	ii
ABSTRAK	v
DAFTAR ISI	vii
DAFTAR TABEL	x
DAFTAR GAMBAR	xiii
DAFTAR LAMPIRAN	xv
BAB I. PENDAHULUAN	
A. Latar Belakang Masalah	1
B. Perumusan Masalah	7
C. Pembatasan Masalah	8
D. Tujuan Penelitian	8
E. Manfaat Penelitian	9
BAB II. BIOTEKNOLOGI, BIOENTREPRENEURSHIP, SUMBER DAYA LOKAL, BERPIKIR KREATIF, SIKAP WIRAUSAHA	
A. Bioteknologi	10
1. Pengertian Bioteknologi	10
2. Kajian dalam Bioteknologi	12
3. Bioteknologi dan Pembelajarannya	16
B. Bioentrepreneurship	18
1. Pengertian <i>Bioentrepreneurship</i>	18
2. Pendidikan <i>Bioentrepreneurship</i>	19
C. Sumber Daya Lokal	21
1. Sumber Daya Alam dan Sumber Daya Lokal	21
2. Sumber Daya Lokal di Kabupaten Indramayu	22
3. Integrasi Sumber Daya Lokal Pada Pembelajaran	26
D. Kreativitas dan Keterampilan Berpikir Kreatif	27
1. Kreativitas	27

2.	Faktor Penunjang Kreativitas	30
3.	Keterampilan Berpikir Kreatif	31
4.	Keterampilan Berpikir Kreatif dan Pembelajaran	35
E.	Sikap Wirausaha	37
1.	Pengertian Wirausaha	37
2.	Ciri-ciri Sikap Wirausaha	38
3.	Pembelajaran yang melatih Sikap Wirausaha	39
F.	Sintesis Teori	42
G.	State Of The Art	44
BAB III. METODE PENELITIAN		
A.	Paradigma Penelitian	46
B.	Desain Penelitian	49
1.	Tahap Studi Pendahuluan	50
2.	Tahap Perencanaan dan Pengembangan	52
3.	Tahap Implementasi	56
C.	Definisi Operasional	57
D.	Subjek Penelitian	57
E.	Waktu Dan Tempat Penelitian	58
F.	Instrumen Penelitian	58
1.	Tes Berpikir Kreatif dalam Bioteknologi	58
2.	Angket Sikap Wirausaha	59
3.	Tes Konsep Bioteknologi	61
4.	Rubrik Penilaian Produk	62
5.	Catatan Lapangan	62
G.	Analisis Uji Coba Instrumen	62
G.	Teknik Analisis Data	62
1.	Data dari Tahap Studi Pendahuluan, Perencanaan, dan Pengembangan	66
2.	Data dari Tahap Implementasi	67

BAB IV.	TEMUAN DAN PEMBAHASAN	72
A.	Temuan	72
1.	Hasil Studi Pendahuluan	72
2.	Hasil Validasi Program PB4SDL	76
3.	Hasil Ujicoba Program PB4SDL	82
4.	Program Pembelajaran Final dari Program PB4SDL	106
5.	Hasil Implementasi Program PB4SDL	116
B.	Pembahasan	124
1.	Pembahasan Mengenai Karakteristik Program PB4SDL	124
2.	Pembahasan Mengenai Peningkatan Penguasaan Konsep Mahasiswa	132
3.	Pembahasan Mengenai Peningkatan Keterampilan Berpikir Kreatif Mahasiswa	142
4.	Pembahasan Mengenai Kreativitas produk Bioteknologi yang Dihasilkan	161
5.	Pembahasan Mengenai Peningkatan Sikap Wirausaha Mahasiswa	168
6.	Pembahasan Mengenai Keunggulan dan Keterbatasan Program PB4SDL	180
7.	Respon Mahasiswa	182
BAB V.	KESIMPULAN DAN REKOMENDASI	
A.	Kesimpulan	185
B.	Rekomendasi	187
	DAFTAR PUSTAKA	188

DAFTAR PUSTAKA :

- Acquaah, G. (2004). *Understanding Biotechnology: An Integrated and Cyber-Based Approach*. New Jersey: Prentice Hall
- Ahmad, A.(2014). *Bioteknologi Dasar*. Universitas Hasanuddin : Makassar
- Al-Khatib, B .(2012). The Effect of using Brainstorming Strategy in Developing Creative Problem Skills among Female Students in Princess Alia University College. *American International Journal of Contemporary Research* vol 2 no 10
- Alma, B.(2009). *Kewirausahaan*. Alfabeta: Jakarta
- Amabile, T. M. (1993). Motivational synergy: Toward new conceptualizations of intrinsic and extrinsic motivation in the workplace. *Human Resource Management Review*, 3(3), 185–201
- Amabile, T. M. (1996). Entrepreneurial creativity through motivational synergy. *The Journal of Creative Behavior*,31(1), 18–26
- Anderson, L.W. dan Krathwohl, D.R.(Eds) (2010). *Kerangka Landasan Untuk Pembelajaran, Pengajaran, dan Asesmen (Revisi Taksonomi Pendidikan Bloom)*. Yogyakarta: Pustaka pelajar.
- Anderson, N., Potočnik, K., & Zhou, J. (2014). Innovation and creativity in organizations: A state-of-the-science review, prospective commentary, and guiding framework. *Journal of Management*, 40(5), 1297–1333
- Autio, E., Keeley, R. H., Klofsten, M., Parker, G. G. C., & Hay, M. (2001). Entrepreneurial intent among students in Scandinavia and in the USA. *Enterprise and Innovation Management Studies*, 2(2), 145-160.
- Back, S.M.(2008).The Bioentrepreneurship MBA: Options for mid-tier business schools. *Journal of Commercial Biotechnology* (2009) 15, 183 – 193
- Balschweid, M. & Huerta. (2008). Teaching advanced life in animal context: Agricultural science teacher voices. *Journal of Agricultural Education*, 49 (1), hlm. 17-27

- Barak, M & Lavenberg, A (2016). A Model of Flexible Thinking in Contemporary Education. *Journal of Thinking Skills and Creativity*
- Barba-Sanchez, V.(2018). Entrepreneurial intention among engineering students: The role of entrepreneurship education. *European Research on Management and Business Economics* (24) 53–61
- Barrow, L. (2010). "Encouraging Creativity with Scientific Inquiry" *Creative Education*, 2010, 1, 1-6.
- Beetlestone, F (2011). "Creative learning". Philadelphia: Open University Press.
- BELMAWADIKTI (2013). Dokumen deskripsi umum dan learning outcome 12 prodi LPTK.[Online]. Tersedia [http://lpm.iainbanten.ac.id/pocontent/poupload/LAMPIRAN3 % 20Deskripsi % 20 dan % 20 Learning% 20 Outcome % 2012 % 20PRODI % 20LPTK.pdf](http://lpm.iainbanten.ac.id/pocontent/poupload/LAMPIRAN3%20Deskripsi%20dan%20Learning%20Outcome%2012%20PRODI%20LPTK.pdf)
- Berglund, H. & Wennberg, K. (2006), "Creativity among entrepreneurship students: comparing engineering and business education", *International Journal of Continuing Engineering Education*, Vol. 16 No. 5, pp. 366-79.
- Besemer, S & Treffinger, D.J.(1981). Analysis of Creative Product: Review and Synthesis.*The Journal of Creative Behavior*, Vol 13 (3).
- Borg & Gall (2003). *Education Research*. New York : Allyn and Bacon
- Brown, J.T & Kant, A.C.(2008). Creating bioentrepreneurs: How graduate student organisations foster science entrepreneurship. *Journal of Commercial Biotechnology* Vol 15, 125 – 135.
- Buang, N; Halim, L dan Subahan, M.(2009). Understanding the Thinking of Scientists Entrepreneurs:Implications for Science Education in Malaysia. *Journal of Turkish Science Education* Volume 6, Issue 2, August 2009
- Campbell, D.(2017). *Mengembangkan Kreativitas*. Yogyakarta: Kanisius
- Chaiklin, H.(2011). Attitudes, behavior and social practice. *Journal of Sociology & Social Welfare*. Vol.XXXVIII, No.1
- Cheung, C. (2008), "An overview of entrepreneurship education programmes in Hong Kong", *Journal of Vocational Education & Training*, Vol. 60 No. 3, pp. 241-255.

- Choo, S.S.Y, Rotgans, J.I, Yew, E.H.J & Schmidt, H.G.(2011). Effect of Worksheet scaffolds on student learning in problem based learning. *Adv in Health Sci Educ (2011) 16:517-528*
- Ciputra (2010). *Quantum Leap : Entrepreneurship Mengubah Masa Depan Bangsa dan Masa Depan Anda*. Jakarta : Elex media Komputindo
- Collet, C & Wyatt, D.(2005).“Bioneering” – teaching biotechnology entrepreneurship at the undergraduate level. *Education + Training 47(6)*
- Cresswell, J.W & Clark, V.L.P (2007). *Designing and conducting Mixed Methods research*, Sage Publication
- Crispeels, T.(2008).Best Practices for Developing University Bioentrepreneurship Education Programmes. *Journal of Commercial Biotechnology Vol. 15, 2, 136–150*
- Cropley, A. (2006). Creativity: A social approach. *Roeper Review, 28, 125-130.*
- Csikszentmihalyi, M. (1996). *Creativity: flow and the psychology of discovery and invention*. New York NY: Harpercollins.
- Dahar, R.W.(1996).*Teori-teori belajar*. Jakarta: Erlangga
- Deak, G. (2000). The growth of flexible problem solving: preschool children use changing verbal cues to infer multiple words meaning. *Journal of Cognition and Development, 1, 157–191.*
- De caroli, M dan Sagone, E (2010). *Mental Synthesis and Creative Thinking in Learning Disabled Children*. Catania: University of Catania Italy.
- De Obeso O. A., & Wood, S. (2012). An account of cognitive flexibility and inflexibility for a complex dynamic task. *In: 11th International Conference on Cognitive Modeling, 13-15 Apr 2012. Technische Universität Berlin, Germany.*
- Deak, G. (2000). The growth of flexible problem solving: preschool children use changing verbal cues to infer multiple words meaning. *Journal of Cognition and Development, 1, 157–191.*
- Depositario, D.P.T., Aquino, N.A & Feliciano, K.C. (2011). Entrepreneurial skills development Needs of Potential Agri-Based Technopreneurs. *J ISSAAS Vol 17.No.1:106-120*

- Diawati, C.(2017).*Modifikasi alat praktikum kimia instrumen berbasis proyek untuk meningkatkan keterampilan berpikir kreatif mahasiswa calon guru*. Disertasi, Sekolah Pascasarjana, Universitas Pendidikan Indonesia.
- Diefus-Dux, H.A., Dyehouse, M., Bernett, D., and Imbrie, P.K. (2007). Nanotechnology Awareness of First-Year Food Agriculture following a brief Exposure. *Journal of Natural Resources & Life Sciences Education*, 36. 36.58-65
- Dino, R (2015). Crossing Boundaries: Toward Integrating Creativity, Innovation, and Entrepreneurship Research Through Practice. *Psychology of Aesthetics, Creativity, and the Arts 2015, Vol. 9, No. 2*, 139-146
- Dippo, C & Kudrowitz, B (2015).The Effects of Elaboration in Creativity Test as it Pertains to Overall Scores and How it Might Prevent a Person From of Creative Ideas During The Early Stages of Brainstorming and Idea Generation. *Proceedings of the ASME 2015 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference IDETC/CIE 2015*
- Drucker, P.(1993).*Innovation and Entrepreneurship*. New York: Harper Collins Publisers
- Dugosh, K. L., Paulus, P. B., Roland, E. J., & Yang, H. -C. (2000). Cognitive stimulation in brainstorming. *Journal of Personality and Social Psychology*, 79(5), 722–735.
- Eiser .,J.R & van der Pligt, J.(2015).*Attitudes and Decisions*.New York: Psychology Press
- Escaler, M., Teng, P., & Powell, A. (2011). The need for new agriculture, biotechnology and bioscience entrepreneurship in the Asia-Pacific region.*Tech Monitor*, hlm. 14-23
- European Commission (2006). “Entrepreneurship Education in Europe: Fostering Entrepreneurial Mindsets through Education and Learning,” *Final Proceedings of the Conference on Entrepreneurship Education in Oslo*.
- European Federation of Biotechnology (2015). Definition of Biotechnology. <http://www.efbiotechnology.org/BB/>
- Farashah, A.D.(2013).The process of impact of entrepreneurship education and training on entrepreneurship perception and intention Study of educational system of Iran. *Education + Training Vol. 55 No. 8/9*

- Farzin, F.(2015). An Investigation into the Impact of Techno-Entrepreneurship Education on Self- Employment. *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering* Vol:9, No:3, 2015
- Fayolle, A & Gailly, B (2008). From craft to science: Teaching models and learning processes in entrepreneurship education. *Journal of European Industrial Training* Vol. 32 No. 7.
- File UPI (2012). SAP Silabus dan Deskripsi MK.[Online].Tersedia: http://File.upi.edu>SAP_Silabus_Desripsi_MK_Bioteknologi
- Fraenkel, J & Wallen, N. (2007). *How to Design and Evaluate Research in Education*. New York: McGrawHill.
- Garbuio, M.,et.al. (2017), Demistifying the Genius Entrepreneurship: How Design Cognition Can Help Create The Next Generation of Entrepreneurs. *Learning & Education*
- Guerrero, M.,Cunningham.,J & Urbano, D.(2014). Economic Impact of Entrepreneurial Universities Activities : An exploratory study of the united Kingdom.*ReseachPolicy*.
- Hake, R. (1999). “Interactive-engagement vs traditional methods: a six-thousandstudent survey of mechanics test data for introductory physics courses”. *American Journal of Physics*. **66**, (1), 64-74.
- Hamidi DY, Wennberg K, & Berglund H.(2008). Creativity in entrepreneurship education. *Journal of Small Business and Enterprise Development*. 5(2). DOI 10.1108/14626000810871691
- Heinonen, J. and Poikkijoki, S. (2006), “An entrepreneurial-directed approach to entrepreneurship education: mission impossible?”, *Journal of Management Development*, Vol. 25 No. 1, pp. 80-94.
- Howard, T. J., Culley, S. J., & Dekoninck, E. (2008). Describing the creative design process by the integration of engineering design and cognitive psychology literature. *Design Studies*, 29, 160–180
- Hutagalung, I.(2007). *Pengembangan Kepribadian*. Jakarta : Indeks
- Januarti, N.E. (2013). *Inovasi Model Pembelajaran Berbasis Sumber Daya Lokal*. Tesis S2 sosiologi Universitas Gadjah mada

- Kalyuga,S. (2009). Knowledge elaboration : a cognitive load perspective, *ELSEVIER*,19, hlm. 402-410.
- Karami, S & Agahi, H (2017). SWOT Analysis of strategies for Agricultural Entrepreneurs. *International Journal ofAgricultural management and Development (IJAMAD)*, 307-320
- Karolinska Institutet (2015). *Global Master's Programme inBioentrepreneurship*. [Online]. Tersedia: <http://ki.se/en/utbildning/4bp10-masters-programme-in-bioentrepreneurship>
- Karyadi, B, Ruyani, A, Susanta, A, Dasir, S.(2016). Pembelajaran sains berbasis kearifan lokal pada sekolah menengah pertama di wilayah bengkulu selatan. *Prosiding Seminar Nasional pendidikan Sains (SNPS) 2016*
- Keener, K.*et al.*(2013).*Biotechnology And Its Applications*. NC : NC State University
- Kim, YS., Lee, S W.,& Jeong, JY. (2009). *Creativity Training Programs For Cognitive Components of Creativity*. Suwon : Creative Design Institute
- Ko, S & Butler, J.E.(2007). Creativity: A key link to entrepreneurial behavior. *Business Horizons*, 50, 365–372
- Langer, L.J.(2014). Building a curriculum for bioentrepreneurs. [Online]. Tersedia: <http://www.nature.com/bioent/2014/140801/full/bioe.2014.9.html>
- Law, K.M.Y & Breznik, K. (2016). Impacts of innovativeness and attitude on entrepreneurial intention : among engineering and non-engineering students. *Int Technol Des Educ*. DOI 10.1007/s10798-016-9373-0
- Lindell, T.J. and Milczarek, G.J. (1997). Ethical, legal and social issues in the undergraduate biology curriculum : Encouraging student debate on the social implications of biotechnology. *Journal of College Science Teaching*, 26, 345-349
- Mannan, M.N, Sopyan, A, Sunarno (2015). Pengembangan Perangkat Pembelajaran Berbasis Kearifan Lokal Untuk Mengembangkan Karakter Positif Siswa SD. *Jurnal inovasi dan pembelajaran fisika*, volume 2, nomor 2, November 2015
- Marzano,R,J. (1992). *A different kind of classroom, teaching with dimension of learning*, Alexandria : Association for Supervision and Curriculum Development.

- McEwen, T.(2013). Ecopreneurship as a Solution to Environmental Problems: Implications for College Level Entrepreneurship Education. *International Journal of Academic Research in Business and Social Sciences.*, Vol. 3, No. 5
- Meredith, G.G.(2002).*Kewirausahaan teori dan praktek*.Jakarta
- Meyer, G. D. (2011). “The Reinvention of Academic Entrepreneurship,” *Journal of Small Business Management* 49(1), 1–8.
- Meyers, A.(2008). Enterprise for Life Scientists: Developing Innovation and Entrepreneurship in the Biosciences. *Journal of Commercial Biotechnology* (2008) 14, 355–356. doi:10.1057/jcb.2008.21
- Meyers, A & Hurley,P .(2008). Bioentrepreneurship education programmes in the United States. *Journal of Commercial Biotechnology* Vol 14, 2 – 12.
- Montgomery, B.L.(2004). Teaching The Nature of Biotechnology Using Service-Learning Instruction. *J Nat. Resour .Life. Sci .Educ.* 34,32-38
- Moreno, R. & Valdez,A. (2006). Cognitive load and learning affects of having students organize pictures and words in multimedia environments: the role of student interactivity and feedback. *Educational Technology Research and Development*, 53(3), hlm. 35-45.
- Munandar, U. (2009). *Pengembangan Kreativitas Anak Berbakat*. Jakarta : PT. Rineka Cipta.
- Najafabadi, M;Zamani, M & Mirdamadi, M.(2016). Designing a model for entrepreneurial intentions of agricultural students. *Journal Of Education For Business*2016, Vol. 91, No. 6, 338–346
- Natadiwijaya, I.F. (2015). Kurikulum bioentrepreneurship di berbagai negara di dunia. *Wacana Didaktika.vol(3)* 19
- Natadiwijaya, I.F.(2016). Creativity, Interest and Students Entrepreneurial Quality at Applied Biology Courses based on Local Resources: a case study as a basis for improving the quality of biology teacher education programs. *The Proceeding of ICMSce 2016*

- Natadiwijaya, I.F.(2017). Identifikasi Sumber Daya Lokal Hayati Di Kabupaten Indramayu: Studi Kasus Sebagai Dasar Bagi Pengembangan Produk Berbasis Sumber Daya Lokal. *Prosiding Semnas Biodiversitas Juli 2017 Vol.6 No.2 Hal: 42-45*
- Natadiwijaya,I.F, Rahmat, A, Redjeki, S & Anggraeni S.(2018^a).How to Practice Creative Thinking Skills Through Scaffolding On Biotech Content?.*Journal of Physics:Conf.Series.1013 (2018) 012011.*
- Natadiwijaya,I.F, Rahmat, A, Redjeki, S & Anggraeni S.(2018^b). Sikap Wirausaha mahasiswa Pada Perkuliahan Bioteknologi Bermuatan Bioentrepreneurship. *Mangifera Edu, Vol 3 (1),Juli 2018*
- Natadiwijaya, I.F, Rahmat, A, Redjeki, S & Anggraeni S (2019). Preservices Creative Thinking skills On Biotechneur programs. *Journal of Physics:Conf.Series. (2019)*
- Nazir, M.(2005). *Metode Penelitian*. Ghalia : Jakarta
- Nijstad, B. A., & Stroebe, W. (2006). How the group affects the mind: A cognitive model of idea generation in groups. *Personality and Social Psychology Review, 10(3), 186-213*
- Njoroge, K. T. & Arodho, J. A. (2014). Secondary school student's perception towards agriculture subject in public secondary schools in Nairobi Country, Kenya. *IOSR-Journal of Humanities and Social Science, 19 (7), hlm. 30-36*
- Nurchahyo, H.(2011). *Diktat Bioteknologi*.Yogyakarta: FPMIPA UNY
- Oliver, A. (2014). Biotechnology entrepreneurial scientists and their collaborations. *Research Policy 33 (2004) 583–597*
- Omrod,J,E. (2008). *Psikologi pendidikan*. Jakarta : Erlangga.
- Onen, A.S & Kocak, C (2014). The Effect of Cognitive Flexibility on Higher School Students Study Strategies. *Social and Behavioral Sciences 191, 2346 – 2350*
- Parthasarathy, M., Forlani, D & Meyers, A .(2012).The University of Colorado Certificate Program in Bioinnovation and Entrepreneurship: An interdisciplinary, cross-campus model. *Journal of Commercial Biotechnology (2012) 18, 70–78*

- Paulus, P. B., & Yang, H. C. (2000). Idea generation in groups: A basis for creativity in organizations. *Organizational Behavior and Human Decision Processes*, 82(1), 76-87
- Paulus, P. B., & Brown, V. R. (2007). Toward more creative and innovative group idea generation: A cognitive–social motivational perspective of brainstorming. *Social and Personality Psychological Compass*, 1, 248-265.
- Petty, R & Cacioppo, J.(2018). *Attitudes and Persuasion : Classic and Contemporary Approaches*. New York : Routledge
- Pittaway, L. and Cope, J. (2007), “Entrepreneurship education: a systematic review of the evidence”, *International Small Business Journal*, Vol. 25 No. 5, pp. 479-510.
- Portal Nasional RI.(2010). Sumber Daya Alam Provinsi Jawa Barat. [Online]. Tersedia : <http://www.indonesia.go.id/index.php>.
- Potishuk, V & Kratzer, J.(2017). Factors Affecting Entrepreneurial Intentions and Entrepreneurial Attitudes in Higher Education. *Journal of Entrepreneurship Education Volume 20, Issue 1, 2017*
- Purwanto, N.(2006). *Prinsip-prinsip dan Teknik Evaluasi Pengajaran*. Bandung : PT Remaja Rosdakarya
- Putman, V. L., & Paulus, P. B. (2009). Brainstorming, brainstorming rules and decision making. *Journal of Creative Behavior*, 43, 23-39
- Radu, N.*et.al.* (2015). Educational Management In The Field Of Life Sciences - Blending Learning For Bioentrepreneurs Training. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development* Vol. 15, Issue 2.
- Rahmat, A.(2014). Memanfaatkan Produk Lokal Dalam Menunjang Pembangunan Pendidikan Di Tingkat Sekolah. *Prosiding Mathematics and Science Forum 2014*
- Rietzschel, E. F., Nijstad, B. A., & Stroebe, W. (2006). Productivity is not enough: A comparison of interactive and nominal brainstorming groups on idea generation and selection. *Journal of Experimental Social Psychology*, 42, 244-251.
- Rietzschel, E. F., Nijstad, B. A., & Stroebe, W. (2007). Relative accessibility of domain knowledge and creativity: The effects of knowledge activation on the quantity and originality of generated ideas. *Journal of Experimental Social Psychology*, 43, 933-946

- Rigolizzo, M & Amabile, T.(2015). *Entrepreneurial Creativity : The Role of Learning process and Work Environment Supports*. Oxford : Oxford University Press
- Rijal, M,*et.al.*(2018). Field trip method as an effort to reveal student environmental literacy on biodiversity issue and context. *IOP Conf. Series: Journal of Physics: Conf. Series* **1013** (2018) 012020
- Roberts, T. G. & Ball, A. L. (2009). Secondary agriculture, science as content and context for teaching. *Journal of Agricultural Education*, 50 (1), hlm. 81-91
- Rush, C & Roy, R (2001). Expert judgement in cost estimating: Modelling the reasoning process. *Concurrent Engineering*, 2001;9:271-284
- Rustaman, N; dkk. (2005). *Strategi Belajar Mengajar Biologi*. Malang: UM Press.
- Sadler-Smith, E.(2014). *Wallas' four-stage model of the creative process : More than meets the eye?*. Guildford: University of Surrey
- Sari, D.K.(2017). *Pengembangan Program Perkuliahan Praktikum Biokimia Berbasis Proyek Dengan Material Lokal Untuk Meningkatkan Kreativitas Mahasiswa*. Disertasi, Sekolah Pascasarjana, Universitas Pendidikan Indonesia
- Schnotz,W. & Kürschner,C. (2007). A reconsideration of cognitive load theory. *Journal of Educational Psychologist*, 19, hlm. 469 – 508.
- Seufert, T. Jänen,J. & Brünken. (2007). The impact of instrinsic cognitive load on effectiviness of graphical help for coherence formation. *Science Direct Computer in Human Behaviour* 23, hlm. 1055-1071.
- Shalley, C, Hitt, M & Zhou, Z (2015).*The Oxford Handbook of Creativity, Innovation, and Entrepreneurship*. Oxford: Oxford University Press
- Silver,C,E,H. Duncan,R,G. & Chinn,C,A. (2007). Scaffolding and achievement in problem based and inquiry learning. *Educational Psychologist*, 42, (2), hlm. 99-107.
- Sirih, M, Erniwati.(2017). Video pembelajaran IPA berbasis potensi lingkungan lokal sebagai sumber belajar siswa SMP/MTs di sulawesi tenggara. *Seminar Nasional Pendidikan Sains (SNPS) UNS Surakarta 2017*

- Slavin, R.E.(2008). *Psikologi Pendidikan : teori dan praktik*. Jakarta : PT Indeks
- Smith, J.E.(2009). *Biotechnology (fifth edition)*. Cambridge : Cambridge University Press
- Snyder, L.U., Gallo, M., Fulfor, S.G., Irani, T., Rudd, R.,DiFino, S.M., and Durham, T.C .(2008). European Union’s Moratorium Impact on Food Biotechnology: A Discussion-Based Scenario. *Journal of Natural Resources & Life Sciences Education*, 37, 27-31
- Squalli, J & Wilson, K.(2014). Intelligence, creativity, and innovation. *Intelligence* 46 (2014):250-257
- Stephenson, L. G., Warnick, B. K., & Tarpley, R.S. (2008). Collaboration between science and agriculture teacher. *Journal of Agricultural Education*, 49 (4), hlm. 106-119
- Sudijono, A (2011). *Pengantar Evaluasi Pendidikan*. Jakarta: PT Rajagrafindo Persada.
- Suherman, E.(2003). *Evaluasi Pembelajaran Matematika*. Bandung: IKIP Bandung Press.
- Sulaeman, A.A.(2016). *Program Pendidikan dan Pelatihan Kreativitas Guru Biologi SMA dalam Pembelajaran Berbasis Komoditas Hayati Unggulan Lokal*. Disertasi, Sekolah Pascasarjana, Universitas Pendidikan Indonesia
- Supriadi, D.(2001). *Kreativitas, Kebudayaan, dan Perkembangan IPTEK*. Bandung: Alfabeta
- Suyanto, E dan Sartinem.(2009). Pengembangan Contoh Lembar Kerja Fisika Siswa dengan Latar Penuntasan Bekal awal Ajar Tugas Studi Pustaka dan Keterampilan Proses Untuk SMA Negeri 3 Bandarlampung. *Prosiding Seminar Nasional Pendidikan*
- Syah, M. (2003). *Psikologi Belajar*. Jakarta: PT Raja Grafindo Persada.
- Talajan, G.(2012).*Menumbuhkan Kreativitas dan Prestasi Guru*.Yogyakarta: Laks Bang PRESSindo
- Teng, P. S. (2012). Linking education to socially-relevant bioentrepreneurship for sustainable development. *Biology Education for Social and Sustainable Development*,. (Eds.), hlm. 5–18.
- Thomas, M.,Hughes, S.G.,Hart, P.M., Schollar, J.,Keirie, K and Grififth, G.W. (2001). Group project work in biotechnology and its impact on key skills. *Journal of Biological Education*, 35, 133-140

- Tood, A and Murphy, D.J. (2003). Evaluating University Masterclasses and School Visits as Mechanism for Enhancing Teaching and Learning Experiences for Undergraduate and school pupils. A pilot Study Involving Biotechnology student. *Bioscience Education e Journal*, 1-10
- Treffinger, D.J, *et.al.*(2002). *Assesing Creativity : A Guide for Educators*. Storrs: University of Connecticut
- Trnova, E. (2014). IBSE and creativity development. *Science Education International*, 25(1), hlm. 8–18.
- Urban, K. (1995). *Creativity, a Handbook of Teacher*. Singapore: World Scientific Publishing.
- Van Praag, C. M., and P. H. Versloot (2007).“What Is the Value of Entrepreneurship? A Review of Recent Research,” *Small Business Economics* 29(4), 351–382
- Vijaya, C. *et.al.*(2015). Entrepreneurship Competencies and Competitive Advantage of Small and Medium Enterprises of Odisha. *International Journal Of Management (IJM)*. Volume 6, Issue 1, January (2015), pp. 740-757
- Warburton, H & Martin, A (1999). *Local People Knowledge in Natural Resources Research*. Greenwich : Natural Resources Institute
- Welle-strand, A & Tjeldvoll, A. (2003). Creativity, curricula and paradigms *Scandinavian Journal of Educational Research*, 47 (3), 359–372.
- Wisanti & Astriani.D.(2018). Bryological exploration: field-trip based learning to develop competencies of science teacher candidate. *IOP Conf. Series: Journal of Physics: Conf. Series 1006 (2018) 012006*
- Witt, Ulrich & Zellner.C. (2005). Knowledge-based Entrepreneurship: The Organizational Side of Technology Commercialization. *Journal of Economic Literature*
- Yager, S., O., Dogan, O, K., Haceeminoglu, E., & Yager, R., E. (2012). The role of student and teacher creativity in aiding current reform efforts in science and technology education. *National Forum of Alied Educational Research Journal*, 25 (3), hlm. 1-22

Yeh, Y.C. *et.al.*(2011). Knowledge management in blended learning : Effects on Professional Development in Creativity Instruction. *Computers & Education* 56 (1), 146-156, 2011

York, A.S., McCarthy, K.A & Darnold, T.C.(2008). Teaming in biotechnology commercialisation: The diversity performance connection and how university programmes can make a difference. *Journal of Commercial Biotechnology* Vol. 15, 1, 3–11